VOL. IX, No. 3 SEPTEMBER, 1937

PROCEEDINGS

OF THE

HAWAIIAN ENTOMOLOGICAL SOCIETY

FOR THE YEAR 1936

HONOLULU, HAWAII

PRICE 75 CENTS

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All correspondence should be addressed to the Secretary, Hawaiian Entomological Society, Honolulu, Hawaii, from whom copies of the Proceedings may be purchased.

Volume I of the Proceedings, for 1905-07 (in five numbers), contains 210 pages, 4 plates, and 5 text figures.

Volume II, 1908-12 (in five numbers), containing 311 pages, 7 plates, 5 cuts, and 1 portrait.

Volume III, 1913-17 (in five numbers), contains 500 pages, 8 plates, and 6 cuts.

Volume IV, 1918-20 (in three numbers), contains 610 pages, 10 plates, and 25 cuts.

Volume V, 1921-23 (in three numbers), contains 486 pages, 12 plates, and 34 cuts.

Volume VI, 1924-26 (in three numbers), contains 558 pages, 23 plates, and 12 cuts.

Volume VII, 1927-30 (in three numbers), contains 516 pages, 11 plates, and 24 cuts.

Volume VIII, 1931-33 (in three numbers), contains 544 pages, 25 plates, 1 portrait, and 13 cuts.

Volume IX, 1934-36 (in three numbers), contains 468 pages, 19 plates, and 25 cuts.

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PROCEEDINGS

OF THE

Hawaiian Entomological Society

VOL. IX, NO. 3 FOR THE YEAR 1936 SEPTEMBER, 1937

JANUARY 2, 1936

The 361st regular meeting of the Hawaiian Entomological Society was held at the Experiment Station, H.S.P.A., January 2, 1936, at 2:30 p. m.

Members present: Miss Amy Suehiro, Messrs. Bryan, Ehrhorn, Illingworth, Keck, Rosa, Schmidt, Swezey and Williams.

Visitors: Jas. K. Holloway and Robert H. Lawder.

President Keck called the meeting to order.

The minutes of the preceding meeting were approved as read.

REPORTS OF OFFICERS AND COMMITTEES

Mr. O. H. Swezey reported that as authorized, he had written the article on the Entomology of Hawaii for transmission to the Pacific Coast branch of the American Association for the Advancement of Science, this being part of an invitation program to said Association to hold a meeting in Honolulu.

Mr. J. S. Rosa reported that he had audited the financial accounts of the Society for the year 1935 and found them to be correct. Mr. Swezey then moved that the auditor's report of the Society's treasurer, and the treasurer's report as well, be accepted and placed on file; seconded by Mr. E. M. Ehrhorn, and passed.

PAPERS ON LOCAL SUBJECTS

Mr. O. H. Swezey presented a paper entitled "A New Species of Dictyophorodelphax from the Island of Lanai".

EXHIBITION AND DISCUSSION OF LOCAL MATERIAL

Trichogramma minutum Riley.—Mr. Swezey exhibited four specimens of this tiny chalcid which had issued from an egg of

Danaus archippus (Fab.) found on a leaf of *Gomphocarpus physocarpus* in his garden in Manoa Valley, Dec. 28, 1935. It is the first record in Hawaii of this parasite from the egg of this butterfly.

Plusia chalcites Esp.—Dr. Illingworth reported that moths were again observed in flight about plants in Kaimuki during November. This pest was held so well in check by natural enemies that only slight injury to foliage was noticeable, even on such favorite plants as Geraniums, Coleus, etc. Several very young caterpillars were found, but these disappeared before coming to maturity—evidently by predators. A single fully-fed caterpillar taken was put in a tube, where it spun up and pupated. A Tachinid fly, *Chaetogaedia monticola* Bigot, emerged.

Mesovelia mulsanti White.—Dr. Williams reported that this water-striding bug, first recorded here in 1933, is now widespread in the lowlands of Oahu. It occurs in ornamental ponds, lowland reservoirs, taro patches, etc., and being a fierce predator must considerably affect the insect fauna of its environment.

Celerio, probably *calida* (Butler).—Dr. Williams reported having seen a specimen of this Sphinx moth feeding at the flowers of *Plumbago* alongside of the social hall at Ewa Plantation, in the noon sunshine of December 18, 1935.

Culex quinquefasciatus Say.—Dr. Williams reported that on December 1, 1935, this mosquito was very abundant in the low growth on the Manoa-Palolo ridge. These insects had evidently been carried by the strong N. E. trades, then blowing, from the windward or N. E. side where Mr. J. S. Rosa reported *Culex* very plentiful. They occurred in numbers even on the summit of Olympus, 2,400 feet above sea level.

Charadromyia torrenticola Terry.—Dr. Williams called to attention that Edwards in the publication Konowia, 7, 1928, p. 236, states that Terry's genus *Charodromyia,* for curious aquatic Hawaiian chironomid flies, has been synonymized with *Telmatogeton.*

Clunio pacificus Edwards.—Dr. Williams reported a second marine chironomid fly from the Waianae coast. It appears to belong to the genus *Clunio* and much resembles the illustration of

Clunio pacificus described by Edwards from Samoa. The flies have been sent to the British Museum for determination.

Mr. R. H. Lawder spoke on treating lumber against ravages by termites and dry rot fungus, with Wolman's salt solution, the solution becoming fixed in the wood so that there is no leaching out to any degree. Treated and untreated wood was exhibited. A few futile attempts had been made by termites to enter the Wolmanized wood, while the check lumber untreated was very severely damaged by the termites. Both pieces of wood had been placed side by side in the soil.

Tenodera angustipennis Sauss.—Mr. E. H. Bryan, Jr., mentioned having seen the large mantis *Tenodera angustipennis* at Wawamalu Beach towards Makapuu, Oahu. Mr. C. B. Keck had seen it at Lanikai and Mr. J. S. Rosa at Waimanalo. The mantis was then held under discussion for a few minutes.

EXHIBITION AND DISCUSSION OF FOREIGN MATERIAL

Mr. O. H. Swezey showed photographs of two types of Australian termite mounds and specimens of one of the termites.

Miss Amy Suehiro gave an interesting account of her trip to Madrid, Spain, where the International Entomological Congress was held in 1935 and which she attended as representative of the Hawaiian Entomological Society. En route an entomological meeting at Los Angeles, Cal., was attended. The entomologists were made very welcome in Madrid, were spared many expenses, tendered receptions, and other forms of entertainment. In England, Miss Suehiro attended a meeting of the London Entomological Society. Particularly worthy of note were the fine exhibits of plant and insect hosts for students of natural history in the British Museum.

Mr. Holloway of the Bureau of Entomology, U.S.D.A., spoke of some of his work on the *Popillia* beetle at Moorestown, N. J., and of the efficient control of the oriental fruit moth by a *Macrocentrus* wasp parasite.

FEBRUARY 6, 1936

The 362nd regular meeting of the Hawaiian Entomological Society was held at the Experiment Station, H.S.P.A., February 6, 1936, at 2:30 p.m.

Members present: Miss Amy Suehiro, Messrs. Bryan, Ehrhorn, Illingworth, Keck, Mason, McBryde, Pemberton, Rosa, Schmidt, Swezey, and Williams.

Visitors: Walter Donaghho and Robert Cushnie.

President Keck called the meeting to order.

The minutes of the preceding meeting were approved as read.

EXHIBITION AND DISCUSSION OF LOCAL MATERIAL

Hercothrips femoralis (Reut.)—Mr. Swezey exhibited a slide mount of this thrips taken from leaves of sugar cane in greenhouse at the Alexander Street plot of the Experiment Station, H.S.P.A., Jan. 16, 1936. Mr. Carpenter, who is conducting experiments on insect transmission of cane diseases, discovered the thrips a few days previously and called Dr. Williams' attention to them on Jan. 15. It is the first record of this thrips on sugar cane in Hawaii, and we have not yet found it on cane in the open. It has been found on orchids in greenhouses, and on pineapple, tomato and several weeds in greenhouses at the Experiment Station of the Pineapple Producers' Cooperative Association.

Selenothrips rubricinctus (Giard)—Specimens of this thrips, which had done considerable damage to the foliage of Christmas berry (*Schinus terebinthifolius* Raddi.) were exhibited by Dr. Illingworth. The terminal leaves, for a space of 6 or 8 inches, were so badly damaged that they dropped off. The adult thrips do most of their feeding on the upper surface of the leaves along the veins. The nymphs are found only below. These congregate in clusters and are partially protected by a slight webbing and bits of rubbish clinging to it. The young larvae have a cluster of six very conspicuous, long, caudal bristles. These are moulted with the last larval coat and are not present in the pupae. This species was first found in the islands by Fullaway in 1909. He collected it on mango. Swezey took it on *Croton* in 1927. During the present investigation, Dr. Illingworth also found it on the leaves of mango and *Croton,* and on strawberry guava. On none of these plants were the thrips sufficiently numerous to do noticeable damage. This thrips was described in 1901 from Guadalupe, where it is a pest of cacoa. It was also recorded from guava, roses, almonds, and mangoes in Trinidad. Russell calls it the Red-

Banded Thrips in describing its work on mangoes and avocados in Florida. (Russell, H. M.—U. S. Dept. Agr., Bur. Ent., Bul. 99, Pt. II, 1912.)

Mr. R. L. Usinger submitted the following notes: Eight days were spent on Kauai from December 28, 1935, on. Although there was a great deal of rain the collecting was rather good. Moths were very abundant, coming to lights at night at Kokee and flying about during light showers in Alakai Swamp. Among the Heteroptera, three undescribed species of *Nysius* were taken on Kumuwela Ridge in great numbers and several endemic Nabids were collected. *Mesovelia mulsanti* White was seen skating on the water in taro patches near Haena, this being the first record of this bug from Kauai.

On Jan. 18, 1936, a visit was made to Rabbit Island. *Geocoris punctipes* Say, *Oligotoma insularis* McLach., *Triphleps persequens* White, *Reduviolus capsiformis* (Germar), and *Nesiomiris hawaiiensis* Kirk. were all very common and should be added to Bryan's list. This difference in the fauna is very likely seasonal and correlated with plant abundance as the vegetation was much thicker than during Bryan's visit.

Dr. C. Schmidt exhibited some of the work of his students in Entomology at the University of Hawaii. Excellent insect collections—extensive and well labeled—were shown as well as good drawings of dissections of the large cockroach.

Dr. Schmidt also submitted the following notes: On January 28, 1936, the director of the playground near the University called attention to the fact that children would not use the grounds because they were being repeatedly stung by honey-bees crawling in the grass. When this was investigated, it was found that the bees were being attracted to the grass by the presence of large numbers of the scale, *Antonina indica* Green. The bees were licking the stems of the grass for the sweet secretions of the scales. It has been observed that the scale generally is found on the roots of grasses, but in this case the soil was very hard so that the scales were above the ground level and located in the region of the grass joints. The nuisance was temporarily abated by the heavy rains which washed the secretions from the grass stems.

One hundred and forty specimens of *Tetrastichus hagenowii* (Ratz.) were recovered from a single egg capsule of *Periplaneta*

americana (L.) on January 27, 1936. The contents of the capsule were so badly mutilated that it was not possible to determine whether they were primary or secondary parasites. Since these capsules were recovered from caged roaches it is extremely likely that they are primaries since the screen on the cages would not permit the entrance of a larger parasite. The parasites were determined by Dr. Williams.

MARCH 5, 1936

The 363rd regular meeting of the Hawaiian Entomological Society was held at the Experiment Station, H.S.P.A., March 5, 1936.

Members present: Miss Amy Suehiro, Messrs. Bryan, Chock, Ehrhorn, Illingworth, Keck, Mason, Rosa, Swezey, Usinger, Weinrich, and Williams.

Visitors: Emil A. Freedman, Jr., and Jas. K. Holloway.

President Keck called the meeting to order.

The minutes of the preceding meeting were approved as read.

PAPERS OF LOCAL SUBJECTS

Mr. R. L. Usinger presented a paper entitled "A New Species of Koanoa from the Hawaiian Islands".

EXHIBITIONS AND DISCUSSIONS OF LOCAL MATERIAL

Mr. E. M. Ehrhorn spoke of a heavy infestation of coconuts by *Pinnaspis minor* (Mask.) scale.

Miss Amy Suehiro presented the following note on *Isodontia harrisi* Fernald.—The cocoons of this immigrant wasp were found in the midribs of dead *Pandanus* leaves in the Bishop Museum courtyard. They were found in September, 1934, and emerged on February 28, 1936, a pupation period of over a year and a half.

Agrotis ypsilon Rott.—Mr. Swezey exhibited potatoes eaten by the greasy cutworm. They were taken from a large field of potatoes being harvested by Oahu Sugar Co., grown on some of their fallow cane land. An occasional potato has been found with the cutworm in the cavity which it had eaten while the potato was *in situ* before the harvesting commenced. This seems to be an hitherto unrecorded habit for this cutworm. One worm can do

considerable injury, for when placed with an uninjured potato, a full-grown worm over night ate a cavity equal to its own bulk.

Chloridea obsoleta (Fab.).—Mr. Swezey reported having collected two caterpillars of the corn earworm from *Ageratum* and *Gossypium tomentosum* flowers on the flats near Makapuu Head, Jan. 19, 1936. From the caterpillar on *Ageratum* a larva of *Hyposoter exiguae* (Vier.) issued Jan. 24; and from the caterpillar on *Gossypium* 2 maggots of *Frontina archippivora* Will. issued January 29.

Pseudococcus pseudonipae (Ckll.).—Mr. Swezey exhibited a plant of *Cocos romanzoffiana* which had an infestation of mealybugs resembling *Pseudococcus nipae*. When examined by Mr. Ehrhorn it was pronounced *P. pseudonipae*. The plant was growing amongst others similarly infested at the Vineyard St. Nursery.

Mr. E. H. Bryan, Jr., exhibited a very creditable collection made by Yoshio Oshiro, of Honolulu, as follows: 75 species—30% Coleoptera, 25% Hymenoptera, 16% Diptera, 10% Lepidoptera, 10% Heteroptera, 3% Homoptera, 3% Neuroptera, 1½% Orthoptera, 1½% Dermaptera.

Mr. R. L. Usinger exhibited photographs of *Salda* bug eggs.

Dr. F. X. Williams spoke of having found on February 9, a dipterous leaf-miner, allied to *Lemnaphila**, in Lemna plants that covered the water surface of a cement trough in Kukuiala Valley, Waianae Mts. He had taken it previously on Molokai.

EXHIBITION AND DISCUSSION OF FOREIGN MATERIAL

Mr. Mason reported on the introduction into Hawaii on February 20, 1936, of four species of fruit-fly parasites. Three of these, *Opius* sp., a red parasite closely resembling *O. fletcheri* in appearance, *Opius* sp., a smaller black insect, and *Hedylus* sp., a large braconid with a long ovipositor, were prepared and shipped by R. H. Van Zwaluwenburg, in Sierra Leone, West Africa. The fourth species is *Opius crawfordi*, a parasite on *Anastrepha fraterculis* in Mexico, and was shipped by W. E. Stone from Mexico City. The African parasites were reared from *Ceratitis punctata* and *C. giffardi*.

Liberations were made on February 20 of parts of the ship-

* Later described as *Hydrellia williamsi* by E. T. Cresson, Jr., Trans. Am. Ent. Soc. 62, p. 259, 1936. [Ed.]

ments of the three species of *Opius* in favorable localities on Oahu. The remainder of these shipments and all of the *Hedylus* sp. were held for cage rearing in the laboratory.

APRIL 2, 1936

The 364th regular meeting of the Hawaiian Entomological Society was held at the Experiment Station, H.S.P.A., Honolulu, April 2, 1936, at 2:30 p. m.

Members present: Miss Amy Suehiro, Messrs. Ehrhorn, Illingworth, Ito, Keck, Mason, Pemberton, Rosa, Schmidt, Swezey, Usinger, and Williams.

Visitors: Miss Bertha Hanaoka, Messrs. Walter Donaghho, Richard T. Fujio, Jas. K. Holloway, Sabuco Maehara, Takeschi Nishijima, and Richard S. Suzui.

President Keck called the meeting to order.

The minutes of the preceding meeting were approved as read.

PAPERS ON LOCAL SUBJECTS

Mr. O. H. Swezey presented 2 papers entitled: "Notes on the Food of the California Quail in Hawaii", and "Notes on Potato Insects in Hawaii".

PAPERS ON FOREIGN SUBJECTS

Dr. Walter Carter presented a paper by Mr. Harold Compere entitled "The Species of Aenasius, Encrytid Parasites of Mealybugs".

EXHIBITION AND DISCUSSION OF LOCAL MATERIAL

Crocidosema lantana Busck.—Mr. Swezey reported that Mr. L. W. Bryan had sent from Hilo a twig of Litchi having a larva boring in the stem which was identified as the larva of this moth. It turned out to be parasitized by what is apparently *Pristomerus hawaiiensis* Perk.

Simplicia lautokiensis Prout.—Mr. Swezey called attention to this species of moth as figured in Insects of Samoa, Pt. III, Fasc. 4, Pl. XII, Fig. 13, 1935, and that the species in Hawaii and recorded as *robustalis* Guen. is this species (*lautokiensis*) if the two are distinct species. *Simplicia robustalis* is figured in Moths

of India, Vol. III, p. 36, 1895. Comparing the figures it is noticeable that there are differences in wing markings which are not brought out in descriptions.

Heteramphus hirtellus Sharp*, or n. sp.—Mr. Swezey exhibited a pair of weevils which may be *hirtellus,* a species collected just once by Mr. Blackburn and never since his time. The description in Fauna Hawaiiensis is too meager for positive determination. The present specimens are different from all other species of the genus which have been described. They were found under loose bark of a dead *Straussia mariniana* tree on the trail to Mt. Olympus, March 29, 1936. A dead specimen was also found. All were near the base of the tree, and seem to indicate its habitat, tho no larvae were found.

Dromaeolus pachyderes Sharp.—An adult of this melasid beetle was found in the same situation as the above. There were also numerous adults of *Proterhinus subplanatus* Perkins which is often found abundantly under *Straussia* bark.

Eumerus sp.—Mr. Swezey exhibited a specimen of this undetermined recent immigrant which had bred in a rotten sweet potato at the Experiment Station, H.S.P.A. grounds. Several maggots were feeding in the potato, but only one fly had matured so far. It seems to be the first record of the rearing of this immigrant fly in Hawaii.

Thripoctenus sp.—Mr. Swezey exhibited a slide mount of a *Thripoctenus* collected from Nasturtium leaf where there was quite an infestation by *Thrips tabaci* Lind. This was at Dr. Shepard's residence in the Punahou School grounds, March 7, 1936. From a hand full of infested leaves brought in, four more specimens of *Thripoctenus* were obtained. If this is the species introduced from Formosa in 1934, this is the first record of its recovery. This also appears to be the first record of Nasturtium being infested by onion thrips in Hawaii.

Mitrastethus bituberculatus (Fab.)—A specimen of this curculionid was exhibited by Mr. Ehrhorn, found by him on a plant box at his home in Manoa Valley, March 20, 1936. He has pre-

* Later, Mr. Zimmerman studied these specimens and pronounced them a variety of *Heteramphus swezeyi* Perkins. [Ed.]

viously collected the species there in 1917 and 1921, as recorded in the Proceedings of the Society. He found the larvae and pupae on April 1st in wood of nursery boxes—these are butter boxes imported from New Zealand. Mr. Rosa found one specimen in Nuuanu on the screen window.

Dr. Williams reported finding by Mr. Groves, of Aiea, Oahu, and himself of a small unrecorded species of sarcophagid fly—present on Portulaca and Euphorbia on the H.S.P.A. Experiment Station grounds, Honolulu. He placed it tentatively in the genus *Helicobia,* which means living in snails. This genus often merged in *Sarcophaga* has a number of hosts including snails, various caterpillars, Orthoptera, and Scarabeid beetles. It is not yet known what the host or hosts of this fly are in Hawaii.

Mr. R. L. Usinger exhibited a little bug of the family Enicocephalidae, a family related to the Reduviidae and hitherto unrecorded in the Archipelago. The Enicocephalidae are predacious, possess a bilobed head and totally membranous wings. The specimen was taken on West Maui by E. H. Bryan, Jr. Mr. Usinger also exhibited bugs of the genus *Sulamita.*

There followed a discussion of termite control. Diesel oil was regarded as a good improvement here—penetrates well and checks dry rot also.

MAY 7, 1936

The 365th regular meeting of the Hawaiian Entomological Society was held at the Experiment Station, H.S.P.A., Honolulu, on May 7, 1936, at 2:30 p.m.

Members present: Miss Amy Suehiro, Messrs. J. H. Au, Walter Carter, Q. C. Chock, E. M. Ehrhorn, J. F. Illingworth, C. B. Keck, A. C. Mason, R. H. Marlowe, O. C. McBride, C. E. Pemberton, J. S. Rosa, C. Schmidt, S. Tinker, H. F. Willard, and F. X. Williams.

Visitors: Miss Bertha Hanaoka, Messrs. A. C. Baker, R. T. Fujio, G. P. Gray, J. K. Holloway, H. Darwin Kirschman, F. K. Lee, S. Maehara, E. R. Sasscer, D. Starr, Lee A. Strong, and C. Sugiu.

President Keck called the meeting to order.

The minutes of the preceding meeting were approved as read.

NEW BUSINESS

Mr. C. E. Pemberton stated that as a member of the Arrangements Committee for the trip planned by the Hawaiian Academy of Sciences to the Kokee, Kauai region this coming August, anyone having this trip in mind should confer with him.

EXHIBITION AND DISCUSSION OF LOCAL MATERIAL

Dr. C. Schmidt stated that Dr. Wakabayashi sent in specimens of *Apanteles glomeratus* (L.), parasites of *Pieris rapae* from Waiakoa, Maui. This is apparently the first record of recovery from that island. Discussion of this parasite has been made by Swezey—Proc. Haw. Ent. Soc., Vol. 9, No. 1, p. 25 (1934). Specimens were determined by Dr. Williams.

President Keck then called upon the three visitors from the United States Department of Agriculture. Accordingly, Mr. Lee A. Strong, Chief of the Bureau of Entomology and Plant Quarantine, spoke briefly of the work of the Government in his jurisdiction; the emergency appropriations being for the Dutch Elm Disease, and the Screw Worm in S. E. United States—both being very serious conditions. The other appropriations carry on the normal functions of the departments, there being a good deal of research work involved. Mr. Strong advocated drawing more public attention to what the Bureaus are doing.

Mr. Sasscer, in charge of the Foreign Plant Quarantine Work, spoke of the very large number of insects intercepted in this work.

Dr. Baker, in charge of the Fruit Fly investigations in the United States, also spoke briefly on his work.

JUNE 4, 1936

The 366th regular meeting of the Hawaiian Entomological Society was held at the Experiment Station, H.S.P.A., Honolulu, on June 4, 1936, at 2:30 p.m.

Members present: Miss Amy Suehiro, Messrs. E. H. Bryan, Jr., E. M. Ehrhorn, D. T. Fullaway, J. F. Illingworth, C. B. Keck, A. C. Mason, O. C. McBride, C. E. Pemberton, J. S. Rosa, W. Weinrich, and F. X. Williams.

Visitors: A. C. Baker, C. P. Clausen, and W. Donaghho.

President Keck called the meeting to order.

The report of the Executive Committee was then put before the society. It involved a payment of $13.85 on the chop sui banquet of this Spring, and the bill of $1,354.87 from the Star-Bulletin for printing the Proceedings of the Hawaiian Entomological Society, IX, No. 2, April, 1936. It was moved by Dr. Schmidt and seconded by Dr. Illingworth and voted that the payment of $13.85 be approved as paid by the treasury. It was also voted that the Star-Bulletin printing bill of $1,354.87 be approved and that the secretary of the Society approach the Hawaiian Sugar Planters' Association in view to its payment.

PAPERS OF LOCAL SUBJECTS

Miss Amy Suehiro presented a paper entitled "New Records of Mealybugs in Hawaii".

EXHIBITIONS AND DISCUSSIONS OF LOCAL MATERIAL

Mr. Donaghho exhibited a specimen of *Vespa occidentalis* Cress. which he had recently captured on Nuuanu ridge at 1,300 ft. elevation. This is the first record of this wasp on Oahu. It has been known on Kauai since 1919.

Mr. Rosa exhibited the large *Conoderus* elaterid beetle which he had reared from a larva.

Specimens of *Lema nigrovittata* Guerin were sent in to the University from the Kalaheo district of Kauai where they are reported to be doing damage in commercial plantings of poha. May 20, 1936. Carl T. Schmidt.

Dr. Williams mentioned finding, chiefly about crab holes on the sandy beach at Hanauma Bay and vicinity, Oahu, a very active fly of the family Empididae. He placed it tentatively in the genus *Chersodromia*. The family is new to the Islands.

Mr. Keck spoke of an oedemerid beetle *Oxacis collaris* Sharp as being numerous on corn tassels on Sand Island. They were found by Dr. Fricks in charge of the Quarantine Station there.

Drs. Clausen and Baker, and Mr. Fullaway responded in a fitting manner when asked for news.

Muscoid flies.—Mr. Bryan exhibited a copy of part 3 of Dr. C. H. T. Townsend's "Manual of Myiology", 249 pp. 1936. This

part contains 35 pages of keys to the families, and for each family the tribes, of Oesteroidea. This superfamily includes the families Gymnosomatidae, Oestridae, Prosenidae, Rutiliidae, Tachinidae, Dexiidae, and Exoristidae. The balance of the volume gives tribal diagnoses and habits, and keys to the genera, of all but the last two families in this list. The type of each genus, with its locality, is cited. There is an index to genera, and a general index gives reference to parasites of insect pests of various plants and animals. For example one can find several paragraphs and a bibliography regarding the efforts to introduce *Paratheresia claripalpis* Wp. into Sinaloa and Hawaii. This record is incorrect, as this parasite was never introduced into Hawaii nor does it occur in these islands.

Mr. Bryan gave an interesting account of his recent trip to the Island of Guam. He based his talk, illustrated by maps, on the interrelation of Phytography and Geology. Coral exposures predominated at the north and mountains of volcanic origin at the south. Certain types of plants were characteristic of each area.

JULY 2, 1936

The 367th regular meeting of the Hawaiian Entomological Society was held at the Experiment Station, H.S.P.A., Honolulu, on July 2, 1936, at 2:30 p.m.

Members present: Miss Amy Suehiro, Messrs. E. H. Bryan, Jr., Walter Carter, Q. C. Chock, E. M. Ehrhorn, D. T. Fullaway, J. F. Illingworth, C. B. Keck, A. C. Mason, C. E. Pemberton, C. T. Schmidt, and F. X. Williams.

Visitors: Mabel Chong and Jas. K. Holloway.

President Keck called the meeting to order.

The minutes of the previous meeting were read and approved as corrected.

REPORTS OF OFFICERS AND COMMITTEES

Dr. Walter Carter, reporting as a member of the Hawaiian Academy of Sciences' Invitation Committee to the Pacific Coast Branch of the American Association for the Advancement of Science, stated that the invitation to the above Association to hold one of their meetings in the Hawaiian Islands, was in their hands.

NOMINATION AND ELECTION OF MEMBERS

Mr. Walter Donaghho was proposed by President Keck for junior membership.

The Secretary-Treasurer stated that the Hawaiian Sugar Planters' Association had paid the bill for printing the Proceedings of the Hawaiian Entomological Society, IX, No. 2, 1936. Mr. Bryan moved that a vote of thanks be extended to the H.S.P.A. by the Society. Seconded by President Keck. Passed.

EXHIBITIONS AND DISCUSSIONS OF LOCAL MATERIAL

Mr. Chock exhibited specimens of *Belonuchus ephippiatus* (Say) a large immigrant staphylinid beetle with reddish brown elytra. It was found in Kaimuki in chicken manure. It had previously been taken by Chas. Hoyt who gave the specimens to Mr. O. H. Swezey.

Dr. F. X. Williams reported that the one or more nymphs of the large dragonfly *Anax strenuus,* that months ago he had placed in a deep water hole in a Kukui tree in the mountains behind Honolulu, had kept this water hole quite free of the larvae of the day mosquito *Aedes albopictus* (Skuse) that previously swarmed therein.

He also mentioned having seen the immigrant yellow packet wasp, *Vespa occidentalis* Cress., perched on a guava tree at the Waihi-nui Waihi-iki trail junction, upper Manoa Valley, on June 27, 1936. This is the second record of this wasp on Oahu.

Recently a letter was received from the British Museum confirming Mr. Swezey's determination of a now plentiful *Eumerus* syrphid fly, the male of which has the last 4 articles of the hind tarsi flattened and conspicuously silvery white, as *Eumerus aurifrons* (Wd.) (John Smart det.). This fly was first reported from here by Swezey (January 5) and by Pemberton (July) in 1933.

The small sarcophagid recently found on Oahu was determined, also by John Smart, as *Helicobia helicis* Towns. The species, a widely distributed one, has more lately been found at Hanauma Bay and at Waianae.

EXHIBITION AND DISCUSSION OF FOREIGN MATERIAL

Dr. Walter Carter exhibited two species of chalcidid wasp parasitic on the pineapple mealybug. Both are from the neotropics:

Hambletonia pseudoccocina Compere and a species of *Anagyrus* from Brazil, etc. Both species have now been bred and liberated here.

Dr. Carter further made public that Dr. Carl Schmidt, now with the Pineapple Experiment Station, would soon go to Brazil in search of mealybug parasites—after attending to important business on the U.S.A. mainland.

Mr. Bryan spoke of having received on June 28 a letter from Mr. R. L. Usinger in Guam and who had already collected 82 species of Heteroptera on that Island.

Mr. Fullaway also mentioned having received a letter from Mr. O. H. Swezey, in Guam.

AUGUST 6, 1936

The 368th regular meeting of the Hawaiian Entomological Society was held at the Experiment Station, H.S.P.A., August 6, 1936, at 2:30 p.m.

Members present: Messrs. Bryan, Carter, Ehrhorn, Fullaway, Illingworth, Keck, Marlowe, Pemberton, Rosa, Williams, and Zimmerman.

Visitors: Miss Mabel Chong, W. Donaghho, and D. Kirschman.

President Keck called the meeting to order.

The minutes of the previous meeting were read and approved as corrected.

REPORTS OF OFFICERS AND COMMITTEES

Dr. Walter Carter reporting as a member of the Hawaiian Academy of Sciences' Invitation Committee to the Pacific Coast Branch of the American Association for the Advancement of Science, stated that the Academy's invitation that the above Association hold one of its meetings in the Hawaiian Islands had been declined and that the matter was therefore closed.

NOMINATION AND ELECTION OF MEMBERS

Mr. W. Donaghho was duly elected to junior membership in the Society.

PAPERS OF LOCAL SUBJECTS

Mr. D. T. Fullaway presented a paper entitled "Notes on the Taro Leafhopper (*Megamelus proserpina* Kirk.) Delphacidae".

PAPERS ON FOREIGN SUBJECTS

Mr. E. C. Zimmerman showed one of his recently published papers: A Review of the genus *Orchlesis;* as part three of "Rhyncophora of Southeastern Polynesia".

EXHIBITIONS AND DISCUSSIONS OF LOCAL MATERIAL

Mr. D. T. Fullaway mentioned having reared *Thecla echion* Linn., one of the lantana butterflies, from the Bull Nosed Pepper, and the beetle *Bruchus pruininus* Horn from Erythrina seeds from the Waianae Mts. He exhibited some melon fly parasites collected and shipped in from the Orient by Mr. F. C. Hadden.

Dr. Walter Carter exhibited *Drosophila* flies that had been reared from pineapple plants.

Mr. Walter Donaghho showed a few of the more interesting insects that he had collected on his recent trip to Molokai.

Dr. F. X. Williams exhibited specimens of an immigrant damselfly, of the same family (Coenagrionidae) as our native forms but of the genus *Enallagma,* species near *civile.* Its clearly differentiated black and blue markings contrast quite strongly with the colors and patterns of our native *Megalagrion.* The first specimen was taken July 4, 1936, on a hillside in Manoa Valley; other specimens were secured July 19, about a lowland reservoir at Waianae, Oahu, where also occurred the native species *Meg. xanthomelas.* This immigrant, which obviously has been established here for some time, may have arrived from the Pacific Coast of North America as eggs or nymphs in water plants for aquarium purposes.

He also exhibited the pupal shell, the cocoon, and the adult of an arenophilous dolichopodid fly that was reared from sand beach material of Hanauma Bay, Oahu. The fly is provisionally placed in the large genus *Asyndetus.*

Draeculacephala mollipes (Say)—This large green "sharpshooter" leafhopper was found in mid July at and near Hilo,

Hawaii. This appears to be the first record of this insect from the Island of Hawaii.

A discussion relative to *Megamelus proserpina,* the taro leafhopper, closed the meeting at 3:45 p.m.

SEPTEMBER 3, 1936

The 369th regular meeting of the Hawaiian Entomological Society was held at the Experiment Station, H.S.P.A., on September 3, 1936, at 2:30 p. m.

Members present: Miss Amy Suehiro, Messrs. Bryan, Carter, Ehrhorn, Illingworth, Ito, Keck, Krauss, Mason, Rosa, Pemberton, Sakimura, Williams, and Zimmerman.

Visitor: Charles Hoyt.

President Keck called the meeting to order.

The minutes of the previous meeting were approved as read.

REPORTS OF OFFICERS AND COMMITTEES

It was moved and passed that Dr. Walter Carter's report as of August 6, and relating to the A.A.A.S., be accepted.

UNFINISHED AND NEW BUSINESS

It was moved by Mr. E. C. Zimmerman, seconded by Mr. Ehrhorn, and passed, that a set of the Proceedings of the Hawaiian Entomological Society be sent to Dr. E. C. Van Dyke, of the University of California, in recognition of his assistance in identification of Hawaiian beetles and that he be invited to make a prolonged visit to our shores.

PAPERS ON LOCAL SUBJECTS

Mr. E. C. Zimmerman stated that the work on "Insects of Hawaii" was now under way and that any help in this undertaking would be very welcome. It is a Bishop Museum project.

PAPERS ON FOREIGN SUBJECTS

Mr. E. C. Zimmerman presented a paper entitled: "A New Genus and Species of Baridinae from Amboina".

EXHIBITION AND DISCUSSION OF LOCAL MATERIAL

Mr. K. Sakimura spoke of insect pest surveys, particularly in reference to such vegetables as the onion. Onions were badly affected by *Thrips tabaci,* while *Empoasca solani* caused "leafhopper burn" on various solanaceous plants. A discussion followed. Dr. Walter Carter advocated the use of Bordeau Mixture against *Empoasca* as an effective spray, though not sufficiently used.

Dr. Carter mentioned that fleas were now numerous. This abundance was regarded as seasonal, in response to meteorological conditions favorable to this pest. Various remedies were suggested.

Mr. E. H. Bryan, Jr., gave the following determination of fly material on pineapple, collected by Dr. Carter: *Drosophila melanogaster* Meigen, the common pomace fly, and *Gitona perspicax* (Knab), a mealybug predator.

Mr. Charles Hoyt exhibited a species of damselfly new to the Islands. It apparently belongs to the genus *Ischnura* * and was observed as numerous in the Punahou lily pond, Honolulu, where he first discovered it where it was breeding.

Camponotus maculatus (Fab.) var.—The large carpenter ant or large sugar ant was found by Dr. Illingworth to be a troublesome pest in an old house on Wilder Ave., Honolulu. These insects live between the walls of the building and only appear at night. They come out of holes, made in the paper, and congregate in hordes over the walls. The winged forms, males and females, flew in such numbers to lights over the dining table, as to break up the dinner. The insects got into the hair of the people and caused general confusion. As suddenly as they came, all the alate forms disappeared again into the holes in the walls.

Pseudococcus citri (Risso).—Dr. Illingworth called attention to mangoes heavily infested by mealybugs thought to be this species. The fruit was grown in the yard of the late Gerrit Wilder on Makiki Heights. The trees are so close together that there is dense shade and consequently moist conditions.

Mr. Noel Krauss, lately returned from Equatorial East Africa, where he was engaged in work on fruit fly parasites for the U. S. Government, gave a brief but interesting account of the country and his itinerary.

* Later identified by Mr. John Cowley of England as *Ischnura posita* (Hagen). [Ed.]

OCTOBER 1, 1936

The 370th regular meeting of the Hawaiian Entomological Society was held at the Experiment Station, H.S.P.A., on October 1, 1936, at 2:30 p. m.

Members present: Messrs. Bryan, Donaghho, Ehrhorn, Fullaway, Illingworth, Ito, Keck, Krauss, Marlowe, Pemberton, Rosa, Sakimura, Van Zwaluwenburg, Williams, and Zimmerman.

Visitors: Mabel Chong and Foo Kau Lee.

President Keck called the meeting to order.

The minutes of the previous meeting were read and approved as corrected.

PAPERS ON LOCAL SUBJECTS

Dr. J. F. Illingworth presented a paper by title, i.e. "A Study of Blossom Drop of Tomatoes and Control Measures".

PAPERS ON FOREIGN SUBJECTS

Mr. E. C. Zimmerman presented a paper entitled "A New Chaetectetorus From Fiji (Coleoptera, Curculionidae)".

EXHIBITIONS AND DISCUSSIONS OF LOCAL MATERIAL

Acrodrepanis megalophylla (Meyrick).—Mr. Bryan exhibited a female specimen of this rare moth, which had been collected by Y. Oshiro at Waiakeauka Camp, back of Hilo, Hawaii, in December, 1933. The specimen had been sent to B. P. Bishop Museum for identification by K. Nitta, teacher at the Waiakeauka school, through E. Y. Hosaka of the Museum staff. This is apparently the fourth female specimen to be collected, and the second in local collections. Two male specimens are known. The species was originally described by Meyrick in the Fauna Hawaiiensis (I:p.189, 1899) in the genus *Scotorythra*, for two specimens from Olaa and one from Kona, Hawaii. In 1901 a male specimen from N. W. Koolau Range, Oahu, was described by Perkins as *Acrodrepanis nesiotis*, in the Entomologists' Monthly Magazine (vol. 37, p. 252, 1901). In his supplement to the Lepidoptera, Meyrick stated that he had "no doubt whatever that this is the other sex of my *megalophylla*", and placed that species in the genus *Acrodrepanis* with Perkins' species as a synonym. Perkins in December, 1906, in his summary of the insects of the Kilauea region, noted that this species occurs on the Olaa side. (Proc.

Hawaiian Ent. Soc. I:p.98). Swezey reported the capture of a second male at Kaumana, Hawaii (near Hilo) in 1928. (Proc. Hawaiian Ent. Soc. 7: p. 236, 1929).

S. E. Pacific Insects Papers: Two additional papers on the insects of southeastern Polynesia have just been issued by B. P. Bishop Museum, and are reviewed as follows:

Elwood C. Zimmerman, The Ampagioid weevils of Southeastern Polynesia (Coleoptera, Curculionidae), B. P. Bishop Museum Occasional Papers, vol. XII, no. 10, 38 pp., 4 figs., September 7, 1936. Discusses the genus *Ampagia*, enumerating 43 species from the Australasian and Pacific regions (Malaya, Australia, Tasmania, Lord Howe Island, New Zealand, New Caledonia, Fiji, Samoa, the Society Islands, Austral Islands, Marquesas Islands, and Mangareva Islands), the 19 species and 1 subspecies from southeastern Polynesia all being described as new; and the new genus *Ampagioides*, with six new species from Tahiti, the Austral Islands, and Rapa. Keys are given to genera and species throughout, and the new species are illustrated. Of the specimens studied, 13 were collected by the Pacific Entomological Survey, and 43 by the Mangarevan Expedition, on which Mr. Zimmerman was entomologist. Types in B. P. Bishop Museum.

S. F. Light and Elwood C. Zimmerman, Termites of southeastern Polynesia, B. P. Bishop Museum Occasional Papers, vol. XII, no. 12, 12 pp., 1 fig., Sept. 15, 1936. Six species of Kalotermes are recorded from the Society Islands, Mangareva, Austral Islands, Oeno, Pitcairn, and Flint Island, *Kalotermes* (?) *rapae* being described as new. A check list is presented of ten species found in Hawaii and the island groups of eastern Polynesia, with their distribution. This shows several species widespread in the Pacific, and the suggestion is made that the natural spread of the termite fauna before the advent of man has since been accelerated by the migrations of the indigenous peoples and especially by visits of ships.

Mr. E. M. Ehrhorn exhibited the large elaterid beetle *Chalcolepidius erythroloma* Cand. which he had secured on a dead stump.

Mr. J. S. Rosa showed *Enallagma* sp., a damselfly newly found here. It was common at Kailua, Oahu.

Mr. D. T. Fullaway exhibited a rather uncommon staphylinid

beetle *Philonthus* sp. which Mr. Holloway had taken in Kona, Hawaii. He also recorded the parasitism by *Trichogramma japonicum* Ashm. of eggs of the drone fly *Lathryophthalmus,* probably *arvorum.* The eggs were found on a rice stem. This is a new host record here for this wasp. He also spoke of the abundance of aphids this year. Mention was also made by Mr. Fullaway of the Guam fruit fly parasite collected by Mr. O. H. Swezey. The parasite was an undetermined species closely related to *Biosteres longicaudatus* Ashm.

Dr. F. X. Williams exhibited several species of large picture-winged drosophilid flies which he had taken in a banana grove on the side of Konahuanui.

EXHIBITION AND DISCUSSION OF FOREIGN MATERIAL

Mr. Fullaway showed a copy of Dr. A. da Costa Lima's third part of his Injurious Insects of Brazil and Their Hosts.

Mr. Noel Krauss showed some photographs of his recent trip to Africa.

Mr. R. H. Van Zwaluwenburg gave an interesting account of his work in West Africa. He was engaged by the U. S. Department of Agriculture to search for additional parasites of fruit flies there.

Mr. E. H. Bryan, Jr., spoke of the desirability of having the Proceedings of the Hawaiian Entomological Society review briefly the more important papers referring to entomological work done in the Pacific, both local and exotic. After considerable discussion Mr. R. H. Van Zwaluwenburg moved that the chair appoint a committee on publication policy. President Keck thereafter appointed the committee as follows: E. H. Bryan, Jr., (Chairman), O. H. Swezey, D. T. Fullaway, and Dr. Walter Carter.

NOVEMBER 5, 1936

The 371st reguar meeting of the Hawaiian Entomological Society was held at the Experiment Station, H.S.P.A., on November 5, 1936, at 2:30 p. m.

Members present: Miss Amy Suehiro, Messrs. Bianchi, Bryan, Carter, Ehrhorn, Fullaway, Hadden, Illingworth, Keck, Krauss,

Mason, Rosa, Van Zwaluwenburg, Weinrich, Williams and Zimmerman.

President Keck called the meeting to order.

The minutes of the preceding meeting were read and approved.

PAPERS ON LOCAL SUBJECTS

Dr. J. F. Illingworth presented a paper by title: "Observations on the Predacious Habits of *Cyrtopeltis varians* (Dist.) (Hemiptera)".

PAPERS ON FOREIGN SUBJECTS

Mr. E. C. Zimmerman presented a paper entitled: "The Genus Osseteris in Fiji (Coleoptera, Curculionidae).

EXHIBITIONS AND DISCUSSIONS OF LOCAL MATERIAL

Mr. E. C. Zimmerman discussed the prevalence here of the endemic type of Typhus fever, which spreads from rats to human beings through the intermediary of fleas. A discussion followed.

Mr. D. T. Fullaway in comparing the ichneumonid hitherto recorded here somewhat recently as *Exochus* sp., determined it to be the same as the long established *Metacoelus femoralis* (Four.).

Mr. E. M. Ehrhorn, in further confirmation of the specific identity of the large *Scolopendra subspinipes* Leach centipede and the small, more or less greenish or bluish ones, stated that he had found in a flower pot a mother *subspinipes* nursing her bluish-legged young. He also spoke of finding *Isodontia harrisi* Fernald, the large immigrant grasshopper wasp, constructing a grass nest in an upright half-inch pipe by the pond in his garden.

Mr. E. H. Bryan, Jr., stated that Mr. Ehrhorn's valuable coccid collection and library had been moved from the University of Hawaii to the Bishop Museum.

Lagocheirus obsoletus Thoms.—Dr. Illingworth exhibited stems of Nothopanax hedge plants seriously damaged by the grub of this cerambycid beetle. At the meeting of September, 1935, he reported this species destructive to geranium plants in the same yard.

Triatoma rubrofasciata (De Geer). Dr. Illingworth exhibited a series of this bug, and reported finding it breeding in hundreds

in an old lumber pile at Kaimuki. This predaceous bug feeds on insects. In turning over the lumber, one was found with its beak inserted in a dead American roach. One has to use care in handling them for, if given an opportunity they quickly sink their beak into one's skin. This is an introduced species, long in the Islands, and apparently rather abundant, yet it has seldom been reported in our Proceedings.

Mr. R. H. Van Zwaluwenburg said that the elaterid beetle, *Conoderus eveillardi* Le Guill., first noted here in 1931, was extending its range on Oahu.

Dr. F. X. Williams stated that the recently found sarcophagid fly *Helicobia helicis* Towns. had been noted by Mr. Ehrhorn associated with the immigrant *Eulota similaris* snail. A puparium, probably of *Helicobia* had later been formed from a maggot which issued from the dead snail.

Dr. F. X. Williams exhibited winged female specimens of the endemic ponerine ant *Pseudocrytopone swezeyi*, one of the two species of the genus described from Hawaii by Dr. W. M. Wheeler. These ants were collected on the Mount Olympus trail, at about 1,800 ft. on a bit of mossy ground, on November 1, 1936. Two days later a single de-alated female was taken from under moss a little farther along. There and elsewhere small colonies of the sluggish immigrant *Strumigenys lewisi* Cameron, with long falcate mandibles were encountered in the larval, pupal, and adult worker, and queen stages. *Pseudocryptopone swezeyi* as well as *Ps. zwaluwenburgi* were first taken by Mr. R. H. Van Zwaluwenburg in his soil fauna studies of Hawaiian sugar cane fields, some years ago. He mentioned that the region about Koko Head has recently been freshened by recent rains so that weed plants, etc. are springing up, and the sphinx moth *Deilephila lineata* is about, its green eggs being already found on one of its food plants.

EXHIBITION AND DISCUSSION OF FOREIGN MATERIAL

Mr. F. C. Hadden exhibited some fruit flies and their parasites from the Malay Peninsula. He spoke briefly of his fruit fly parasite work in the Orient on behalf of the Bureau of Entomology, U. S. Department of Agriculture. Among the localities visited were Singapore, Kuala Lumpur, India, and Ceylon, the last country being the most pleasant and interesting.

DECEMBER 3, 1936

The 372nd regular meeting of the Hawaiian Entomological Society was held at the Experiment Station, H.S.P.A., December 3, 1936, at 2:30 p. m.

Members present: 14; visitors: 0.

In the absence of both President and Vice-President, Mr. C. E. Pemberton was voted to take the chair.

The minutes of the previous meeting were read and approved.

REPORT OF OFFICERS AND COMMITTEES

The Treasurer's report for the year 1936 (Dec. 2, 1935 to Dec. 2, 1936) was read and passed. The chair appointed Mr. E. M. Ehrhorn to audit the Society's books.

ELECTION OF OFFICERS FOR 1937

President, J. S. Rosa; Vice-President, Miss Amy Suehiro; Secretary-Treasurer, F. X. Williams; additional member of the Executive Committee, E. M. Ehrhorn.

Chairman Pemberton then reappointed Mr. O. H. Swezey as Editor of the "Proceedings", J. S. Rosa as Librarian, and F. X. Williams as Curator of Collections.

Mr. E. H. Bryan remarked that Mr. Swezey has written some very interesting entomological papers in the Guam Recorder.

PAPERS ON LOCAL SUBJECTS

Mr. Kay Sakimura presented a paper entitled: "Notes on Thysanopterous Fauna in Hawaii". He also presented, on behalf of Dudley Moulton, a paper entitled: "Further Notes on Hawaiian Thrips with Descriptions of New Species".

In collecting thrips and other insects by means of tanglefoot squares set up in the wind, Dr. Walter Carter stated that many and various insects were thus caught.

Mr. R. H. Marlowe presented a paper entitled "Susceptibility of Two Tomato Varieties to Infestation by *Chaetodacus cucurbitae* (Coq.)."

PAPERS ON FOREIGN SUBJECTS

On behalf of Mr. R. L. Usinger, Dr. F. X. Williams presented by title two papers—"Two New Pacific Island Species of

Nysius" and "A New Name for *Nysius monticola* Kirkaldy".

Mr. E. C. Zimmerman presented a paper entitled "A New Genus of Samoan Curculionidae (Coleoptera)".

EXHIBITION AND DISCUSSION OF LOCAL MATERIAL

Mr. Marlowe reported that mites were found on "Solo" papaya at Kailua. The injury caused by the mites in one grove appeared serious as over 50 per cent of the fruit produced were infested. Red egg clusters, nymphs and adults were found in abundance especially on small immature papayas. The mites by feeding, were injuring the outer cells which would die, and thus cause the fruit to become deformed.

Specimens of mites were collected in September, 1936 and sent to E. A. McGregor, Whittier, California, for identification. The mites were identified as the "Privet Mite", *Tenuipalpus bioculatus* McG. The mite has a very wide distribution, having been described originally from South Carolina and occurring commonly in California. Mr. McGregor states that the mite is causing some concern at Corona. One grower dusted nearly 100 acres of lemons, using 400-mesh sulfur and got practically 100 per cent control.

Dr. F. X. Williams stated that while collecting with Mr. Zimmerman about Palikea to 3,110 feet in the Waianae Mountains on November 11, 1936, multitudes of *Carpophilus* beetles (Nitidulidae) were on the wing and were particularly annoying at lunch time. He thought that some fermenting pineapple material and guava fruits on the lower slopes might be responsible for this swarming. The wasp *Proctotrypes hawaiiensis* Ashm., a native insect was abundant on slightly honey dewed leaves of *Rumex gigantea* on the high ridges. Numerous also in these highlands were fungus-gnats and the *Forcypomyia* midge. *Pheidole* ants were common on the summits which here barely enter the mossy forest zone. Later in November a staphylinid beetle, probably a *Philonthus*, was common and active along the trails. In this district at least it seems as if the once very common *Argiope avara* spider now much reduced through the depredations of a wasp, appeared to be becoming replaced by the fat-bodied araneid *Neoscona benjamina*, a spider that spins across trails, etc., an orb web of feebler structure than that of *Argiope*.

Exochus (*Metacoelus*) *femoralis* Fourcroy—Mr. Fullaway reported that as a result of careful comparison with an example of the above species left by Albert Koebele he was able to identify the male wasp taken on window pane at the H.S.P.A. Station on July 26, 1933 (vide Proceedings vol. VIII, p. 378) with same.

Orgilus sp.—Mr. Fullaway reported that in examining his collections recently he had found an example of this braconid (vide Proceedings vol. VIII, p. 13, vol. IX, p. 95) taken from same locality Feb. 5, 1911, antedating Swezey's record 23 years.

Mr. F. A. Bianchi gave a very interesting talk on his fruit fly work in East Africa.

Diachasma suppressed:—Mr. McBride announced that he had notice that the National Museum is now recognizing Gahan's work, (Proc. U. S. Nat. Mus., 49:63, 1915) suppressing *Diachasma* Foerster as a synonym of *Opius* Wesmael, and this view is maintained in the Insect Identification Division, U. S. Dept. of Agriculture. Future publications from the Bureau will in all probability refer to *Dichasma* as a synonym of *Opius*. The fruit fly parasites therefore are *Opius tryoni* and *Opius fullawayi*.

Itinerary of Fruitfly Parasite Expedition to East Africa

BY F. A. BIANCHI

(Presented at the meeting of December 3, 1936)

Leaving Honolulu on September 7, 1935, and New York on October 9, our entomological experiences on foreign soil began in London with a visit to the Farnham House Laboratory and its Director, Dr. Thompson. On the next day we made our way into the lugubrious basement of the British Museum, and met, among other entomologists, Sir Guy Marshall, Dr. C. Ferriere, and, of particular interest to us, the younger son of Dr. Perkins. This young man is said to resemble his father closely, both physically and in the promise of his already considerable entomological achievements.

In Hyeres, France, we spent a day at the European Parasite Laboratory of the U. S. Department of Agriculture and enjoyed the hospitality of Dr. Parker and his co-workers, Messrs. Smith and Sellers, all of whom seemed delighted to entertain visitors from home. The European Parasite Laboratory is probably the only dependency of the U. S. Government where 5 o'clock tea is regularly served as part of the daily routine.

The European quarter of Tanga, Tanganyika, in which we arrived on November 14, consists of a score or two of substantial concrete or frame buildings rather thinly scattered along two or three clean, wide streets. Fronting this area lies Tanga Bay, small but safe, and behind it extends the native quarter, forming a semicircular fringe of native huts about a quarter mile in depth. A good part of the European quarter and most of the native area are thickly planted with old coconut trees, and the rest of the Tanga Plains, from the very edge of town and for about 35 miles inland, to the base of the East Usambara Mts., is practically all given to the cultivation of sisal.

Tanga itself was judged from the first an unfavorable location for our work, but the abolition of the A.A.A., under whose aegis we had been sent to Africa, forced us to remain there until late March of 1936. While still retaining Tanga as headquarters,

however, we visited for periods of various lengths several other areas of interest. These included the island Sultanate of Zanzibar, the East African Agricultural Research Station at Amani, on the rim of the East Usambara Mts., and the high plateau atop the West Usambara Mts., generally called Lushoto, from the name of the largest village of that region.

While many cultivated fruits were found around Tanga, and a great abundance and variety of them in Zanzibar, it was only in Amani that native fruits were found harboring fruit flies. One sapotaceous fruit, *Sersalisia usumbarensis,* yielded two species of fly, probably *Ceratitis capitata* and *punctata,* and two parasites, an Opiine and a *Dirhinus*. We reared a considerable number of the Opiines and made 3 small shipments of them by air; but none of these arrived in good shape even as far as Paris, from where Dr. Parker was to forward them by boat to New York.

On leaving Tanga, Mr. Krauss went to Nairobi, Kenya, and I to Arusha, a beautiful settlement, about 5,500 feet above sea level, on the coffee growing plateau that slopes from the great Meru Volcano. Remaining in Arusha for about a month and seeing no hope of entomological success, I then made my way to Uganda. There, in Kampala and Entebbe, the commercial and political capitals of the country, I became acquainted with a number of Government Officials, including Messrs. Hargreaves and Taylor of the Division of Entomology, who made it possible for me to remain 3 weeks at the Busingiro Forest Station and to spend an equal period of time in an unfortunate barren, but exceedingly interesting, tour of the Northern Province.

The last month and a half of our stay in Africa I spent partly with Mr. Krauss, who had remained most of the time in Nairobi, while I visited Uganda, and partly alone in a second visit to Arusha. Here, in Arusha, coffee had ripened during my absence; but, although I continuously kept a large quantity of the fruit in the laboratory, and upon my departure from Arusha carried about 50 pounds of it along with me, I did not succeed in rearing the parasites which the late Mr. Ritchie, one time Government Entomologist for Tanganyika, had previously reported from this area on *Ceratitis capitata* in coffee.

On June 24, 1936, having secured transportation thither in a

private automobile, I met Mr. Krauss in Mombassa, Kenya, and on that same date we sailed together on our return trip to New York. We carried with us a good quantity of fruit of several kinds, most of it from Nairobi and much of it containing parasitized fruit fly larvae; but none of the material we bred "en route" survived the long five weeks of our voyage, most of the parasites having emerged, very unfortunately, during the first week aboard.

The Species of Aenasius, Encyrtid Parasites of Mealybugs [1]

BY HAROLD COMPERE [2]

(Presented by Dr. Carter at the meeting of April 2, 1936)

INTRODUCTION

Among a miscellaneous lot of beneficial insects [3] imported from Brazil into California were three female parasites which are here described under the name *Aenasius paulistus* n. sp. This species became of special interest when S. E. Flanders, of the Citrus Experiment Station, discovered that it was able to reproduce in *Pseudococcus maritimus* (Ehrh.), a mealybug of economic importance in California. The progeny of the three parasites which reproduced in *P. maritimus* were all of the male sex. One of the original females was still alive when the males issued. She was mated with them and allowed to continue ovipositing. No progeny were obtained from this union, and the breeding stock was lost. The following taxonomic study is an outgrowth of the attempt to classify this parasite.

So far as known the species of *Aenasius* are indigenous to the neotropical regions. All the reared species have been obtained from mealybugs of the genera *Pseudococcus, Phenacoccus,* and *Puto.* The biology of none of the species is known. Presumably they are primary parasites. The species described in this paper as *Aenasius advena* n. sp. was sent for determination to P. H. Timberlake by O. H. Swezey. This species, reared by Swezey from *Pseudococcus virgatus* Ckll., on the island Oahu, was probably purposely introduced into Hawaii in recent years.* *Aenasius paulistus* n. sp. was obtained by the writer in Brazil, but not from *Pseudococcus maritimus,* the host upon which it was propagated in the quarantine room at the Citrus Experiment Station. In Brazil it was obtained

[1] Paper No. 345, University of California Citrus Experiment Station and Graduate School of Tropical Agriculture, Riverside, California.

[2] Associate in the Citrus Experiment Station.

[3] The collection and shipment of miscellaneous beneficial insects from South America to California was incidental to an exploration for enemies of the red scale, *Chrysomphalus aurantii* (Mask.). This exploration for beneficial insects was made by the University of California Citrus Experiment Station. The salary of the writer was paid by the University of California; the traveling expenses were paid from a fund contributed by various organized citrus growers. Several separate papers are in preparation covering the different phases of the South American exploration.

* From Mexico, 1929. [Ed.]

at São Paulo from an undescribed *Pseudococcus* which in life resembles *P. gahani* Green and in stained preparations presents all the usual diagnostic characters of *P. maritimus*. An attempt is being made to secure living specimens of this parasite from Brazil for further experiments.

In this paper eleven new species are described under the genus *Aenasius* Walker. In the female sex these new species appear generically similar to the gentotype except that some of them have tridentate mandibles. Three of the new species are represented by males as well as females. These males differ rather strikingly from

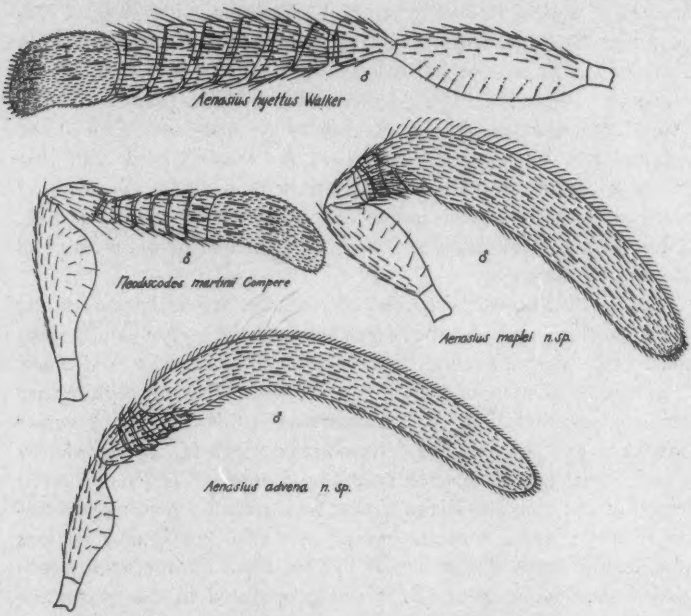

Fig. 1.—Antennae, males, species of *Aenasius* and *Neodiscodes*.

the genotype (fig. 1). In *Aenasius hyettus* Walker, the genotype, the male flagellum is composed of six nearly equal, short, wide, ventrally articulated funicle joints and a short, solid club. In the new species, the male flagellum is composed of from two to five reduced funicle joints and an elongated solid club shaped like a banana, similar to the antennae of male *Chalcaspis* Howard. The

males of the new species are more like male *Chalcaspis* than male *Aenasius,* while the females are more like typical *Aenasius* than *Chalcaspis.* As a matter of fact, *Chalcaspis* Howard and *Neodiscodes* Compere are closely related to *Aenasius* Walker, and the discovery of new species may easily bridge the slight gaps that now exist.

In some respects *Neodiscodes* is intermediate between *Aenasius* and *Chalcaspis.* In the male sex of *Neodiscodes,* the solid club is elongate and about as long as the six-jointed funicle, the basal funicle joints are reduced in size, and those nearest the club appear to be in the process of fusing with the latter. The mandibles are tridentate in *Aenasius caeruleus* Brues, *A. paulistus* n. sp., and in the single species of *Neodiscodes.* In several of the new species represented by one or two tag-mounted specimens a clear view of the apical margin of the mandibles is obscured. The difference in the dentition of the mandibles is not correlated with the different antennal characters of the male sex.

If the species with tridentate mandibles are considered generically distinct from those with bidentate mandibles, it will be necessary to erect a new genus for their reception, since bidentate mandibles characterize both the genotype of *Aenasius* and the species of *Chalcaspis* available for study. In the description of *Chalcaspis pergandei* Howard, the genotype, the dentition of the mandibles is not mentioned. For practical reasons a further subdivision of the group is undesirable. The segregation of the species into different genera on the basis of differences in the dentition of the mandibles and in the male antennae would make it impossible, at this time, to assign the majority of the species to their respective genera. In fact, the relation of these species might be presented more clearly and the classifications simplified by reducing instead of increasing the number of genera.

From Ashmead's description it appears as though *Hemaenasius confusus* is very closely related to the species assembled here under *Aenasius.* In *Hemaenasius confusus,* the anterior portion of the frontovertex is described as smooth and polished and in Ashmead's key to the genera the marginal vein is described as punctiform. The genus *Pentelicus* Howard may be closely related to *Aenasius* and *Chalcaspis. Pentelicus* is described as without a marginal vein; it possesses short stigmal and postmarginal veins, and comparatively

long funicle joints. *Chalcaspis brasiliensis* Mercet belongs to this group of species. It is described in the female sex only, as are *Aenasius chapadae* Ashmead and *Aenasius caeruleus* Brues.

The types of the new species are to be deposited in the United States National Museum, except the holotypes of *Aenasius pacificus* and *A. insularis* which are to be deposited in the entomological collection of the California Academy of Science at San Francisco.

KEY TO THE GENERA OF SHORT, STOUT-BODIED ENCYRTIDS WITH THIMBLE-LIKE PUNCTATION ON THE HEAD THAT ARE KNOWN TO BE PARASITIC IN MEALYBUGS[4]

1. Head usually with a well defined, rather deep facial impression. Marginal vein plainly longer than wide.....2

   Head without a deep facial impression, gently convex from vertex to oral margin, the scrobes faintly impressed. Marginal vein absent or no longer than wide. Entire frontal aspect of the head with coarse thimble punctation similar to the frontovertex. Male antennae with the funicle reduced to two or three short, transverse segments and the club elongate, solid, shaped like a banana.....**Chalcaspis** Howard

2. Thimble punctures descending between the anterior orbits and the upper part of the facial impression. Face often deeply impressed and semicircular above with steeply or gently sloping sides.....**Aenasius** Walker

   Thimble punctation not descending on the frontal aspect of the head between the inner anterior orbits and the upper part of the facial impression. Facial impression shallow, faint. Frontal aspect of head with fine, close, reticulate punctations. Scape moderately expanded. Mandibles tridentate. Male antennae with six transverse funicle joints and solid elongate club, slightly longer than the funicle.....**Neodiscodes** Compere

Aenasius Walker

Aenasius Walker, Ann. Mag. Nat. Hist., Vol. 17, page 181, 1846. Howard, Jour. Linn. Soc., Vol. 25, page 88, 1894.

Female.—Head menisiform in normal position, the frontovertex vertically inclined; occiput strongly concave, acutely angled at the vertex. Fronto-

[4] *Zarhopalus Ashmead* is excluded because of its more slender stature, small scutellum, and faint punctation. Although frequently compared with *Chalcaspis* because of coarse thimble punctation on the head, neither *Discodes* Förster nor *Bothriothorax* Ratzburg belong to this group. *Bothriothorax* is parasitic in dipterous puparia and *Discodes* in comparatively hard coccids. In these two genera the ovipositors are rigid, not enclosed by the ventrites to the apex of the abdomen, and are adapted for the drilling of tough, leathery derm. The forms included here have flexible, thrusting ovipositors for penetrating soft-bodied insects; when in repose these organs are enclosed by the ventrites to the apex of the abdomen. *Eugahania* Mercet, a form parasitic in coccids, may possibly belong in this key, but no specimens of *Eugahania* are available for study and no mention is made of the type of ovipositor in the descriptions.

vertex from one-fifth to one-third width of head, with coarse, impressed, umbilicate punctation which usually descend between the anterior inner orbits and upper portion of the facial impression. Posterior ocelli nearly contiguous with the orbits. Eyes strongly pubescent, large, mostly lateral, reaching downward two-thirds the depth of head. Cheeks short with distinct sulci. Face well impressed, semicircular above and often with steep sides; the area between the sockets plane or slightly raised. Antennae eleven-jointed exclusive of the ring joint, the latter often appearing more like a very short first funicle joint instead of a ring joint. Scape variable, usually widely expanded and compressed below. Pedicel generally approximately one and one-half to two times as long as wide and about as long as the following three funicle joints. Club three-segmented, large, and often obliquely truncate at the apex. Maxillary palpi four-jointed; labial palpi three-jointed. Mandibles either bidentate or tridentate, the teeth rather small, unequal.

Thorax slightly convex above; in some species the scutellum almost plane with vertical sides. Pronotum short, often concealed by the head. Mesoscutum generally plainly shorter than the scutellum, the latter generally large, rounded at apex and often with a short, median, impressed, longitudinal line at the base. Axillae separated; sutures separating the axillae from the scutellum often faint and indistinct. Abdomen short, conic ovate; ovipositor not exserted, when in repose enclosed to apex of abdomen by the ventrites. Femora of forelegs widened and compressed beneath. Legs usually short and inclined to be thick.

Forewings more or less embrowned and coarsely ciliated on the basal portions; often triangular in shape; marginal fringe short; costal cell wide; marginal and postmarginal veins sometimes very narrowly separated from the costal margin; a short, narrow flap at base of blade near the posterior margin folds flat against the blade when wings are in repose and stands at a right angle to the blade when the wings are outspread; marginal vein generally at least twice as long as wide and shorter than the postmarginal vein; postmarginal vein sometimes slightly curved; stigmal vein often not enlarged at apex, about as long as the marginal vein. Hind wings with a wide costal cell; downward projection of the venation often with a short, spur-like, basal vein projecting towards the base.

Mesoscutum, axillae, and scutellum with short, soft setae. Umbilicate punctations on head, each with a more or less flattened refractive seta arising in the center. Coloration dominantly dark metallic; head and parts of the thorax bluish, greenish, or violaceous but usually a blend of these colors.

Length ranging from 1.2 to 2.0 mm.

Male.—The males are smaller in size, more uniformly black with less metallic coloration; wings hyaline or nearly so and finely ciliated; thorax convex; head and antennae different from those in the female sex. The males of only four species are known. The principal difference between the males and females is the shape of the head and the antennal charac-

ters. Frontovertex shorter and more horizontal than in the females; eyes reaching downward about one-half the depth of head; cheeks almost as long as the transverse diameter of the eyes. Face slightly impressed, vertical with head in normal position. Antennae varying as shown in figure 1.

KEY TO THE SPECIES OF AENASIUS FEMALES

1. Scape with a wide expansion below 2
   Scape slightly or moderately expanded below, at least two and one-half times as long as wide 9
2. Antennae completely blackish except the oblique apex of the club which may be brown 5
   Antennae partly testaceous 3
3. Frons not meeting the facial impression at a sharp angle, the sides of facial impression not steep and almost smooth; anterior corners of the eyes not margined by coarse punctations all the way to the genal sulci 4
   Frons almost ledge-like; sharply angled at meeting the facial impression; sides of facial impression almost smooth, steep, and bright blue-green. Two rows of coarse punctations between the orbits and facial impression stop far short of the genal sulci. Scape almost as wide as long and much wider than the club. Forewings slightly inflexed on the posterior margin beyond the thickened edge; a small, hairless, hyaline area just beyond the apex of the postmarginal vein. First five funicle joints testaceous. Panama ..... 1. **frontalis** n.sp.
4. Head dominantly bright green, brassy in proximity to the anterior ocellus; collar of pronotum and mesoscutum faintly greenish in contrast to the faintly bluish-black axillae and scutellum. Legs almost completely blackish except the first four tarsal joints of all legs and knees of middle legs. Mexico, Hawaii ..... 2. **advena** n.sp.
   Head dominantly violaceous, green in proximity to the anterior ocellus and in the facial impression; mesoscutum bluish-black with violaceous reflections, collar of pronotum brighter blue in contrast and the scutellum and axillae darker in contrast. Middle legs almost completely brown. Panama ..... 3. **ianthinus** n.sp.
5. Mesoscutum without thimble-like punctation comparable to that of the head 6
   Mesoscutum with thimble-like punctation similar to that on the head only less distinctly impressed. Head blue, thorax above blue black, beneath aeneous black. Scutellum about twice as long as the mesoscutum. Brazil ..... 4. **chapadae** Ashmead
6. Sides of thorax and the abdomen at base on sides not granular in appearance 7
   Sides of pronotum, prepectus, mesopleura, metapleura, propodeum, and sides of abdomen at base nearly uniformly granular in appearance, this effect produced by fine reticulate punctations. Head and parts of the thorax on sides bright blue. Brazil ..... 5. **punctatus** n.sp.

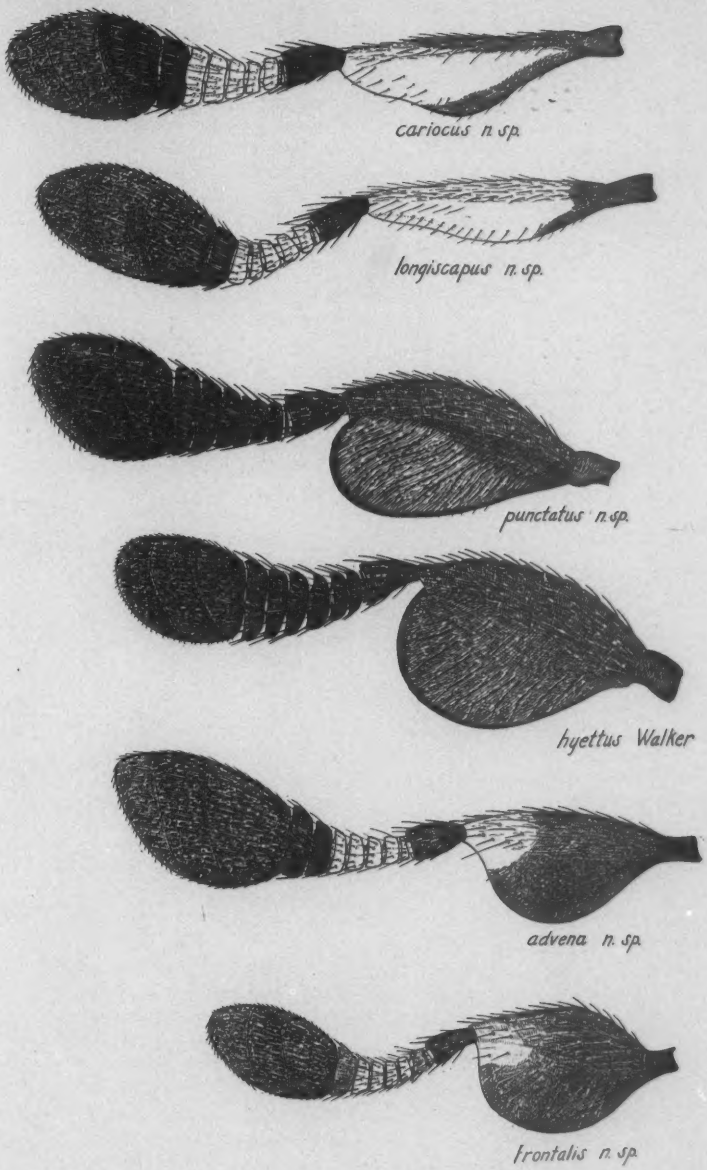

Fig. 2.—Antennae, females, species of *Aenasius*.

7. Mesoscutum and scutellum not bright metallic blue.....8
   Head, mesoscutum and scutellum bright, metallic blue; abdomen bluish with a purple cast. The narrowest part of the frontovertex less than one-fifth the width of head. Facial impression nearly smooth. Scutellum about one and one-fourth times as long as the mesoscutum. Mandibles tridentate. Mexico.....6. **caeruleus** Brues
8. Ocelli in an acute angle; frontovertex at the narrowest part about one-fifth as wide as the head. West Indies, Panama.....
   .....7. **hyettus** (Walker)
   Ocelli in a right angle; frontovertex at the narrowest part slightly more than one-fourth as wide as the head. California..8. **maplei** n.sp.
9. Scutellum with fine tessellate reticulations and setiferous punctation no coarser than those on the mesoscutum. Tegulae brownish or black; femora and tibiae usually more or less brown.....10
   Scutellum with coarse punctations. Tegulae blue. Femora and tibiae blackish. Brazil.....9. **brasiliensis** (Mercet)
10. Umbilicate punctations in two or three irregular rows between the inner anterior orbits and facial impression and descending well below an imaginary line tangent to the upper margin of the facial impression. Forewings with a small, hairless, hyaline break distad of the apex of the stigmal and postmarginal veins. Postmarginal vein not extending as far distad as the stigmal vein and with a long seta at apex.....11
    Umbilicate punctations between the inner anterior orbits and facial impression not descending much below the upper margin of the facial impression. Facial impression shallow, widely semicircular above almost reaching the orbits, the sides slightly declivous. Forewings without a small, hairless, hyaline break distad of the apex of the postmarginal and stigmal veins. Postmarginal vein extending distad slightly further than the stigmal vein and without a single long seta at apex.....13
11. Ocelli in a right triangle. Frontovertex at narrowest with five rows of irregularly placed coarse, umbilicate punctations; two rows of coarse, umbilicate punctations between the inner anterior orbits and facial impression 12
    Ocelli in an obtuse triangle. Frontovertex at narrowest with seven or eight rows of irregularly placed coarse, umbilicate punctations; three rows of coarse, umbilicate punctations between the inner anterior orbits and facial impression. Antennal club twice as long as wide and longer than the pedicel and funicle joints combined. Brazil.....10. **longiscapus** n.sp.
12. Forewings triangular, not reflexed on the outer anal curvature; the integumentary infuscation not extending distad beyond the speculum. Sixth funicle joint and club black. Femora and tibiae of middle and hind legs rather extensively marked with blackish; spur of middle tibiae and apical tarsal joints fuscous. Brazil.....
    .....11. **cariocus** n.sp.

Forewings less distinctly triangular, the posterior margin slightly reflexed on the outer anal curvature; integumentary infuscation gradually fading towards the apex of the blade. Sixth funicle joint and most of the club testaceous. Femora, tibiae, tibial spurs, and all tarsi of the middle and hind legs mostly brown. Tres Marias..... .....12. **pacificus** n.sp.

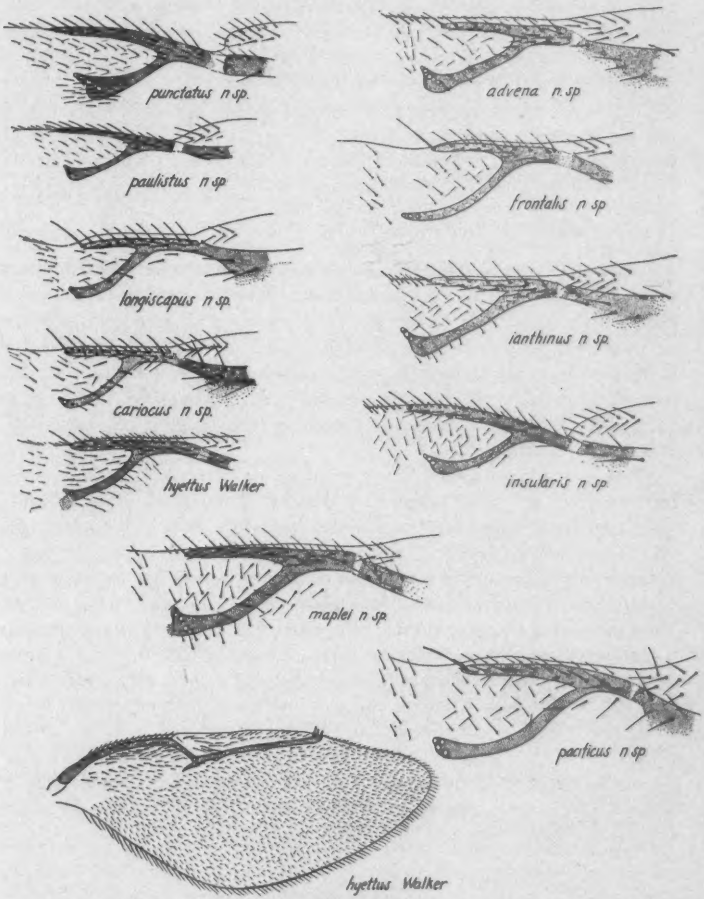

Fig. 3.—Venation, females, species of *Aenasius*, and hind wing of *Aenasius hyettus* (Walker).

13. Antennal club largely testaceous, blackish towards the base. Femora and tibiae of middle legs, tibial spurs, and all tarsi mostly brown. Forewings with the embrowned pattern curving outward from the apex of the stigmal vein to the change of angulation on the posterior margin. Tres Marias.....13. **insularis** n.sp.

Antennal club completely black. Femora and tibiae of middle legs usually dominantly blackish; tibial spur of middle legs and apical tarsal joints blackish. Forewings with the embrowned pattern fading out near the apical margin. Brazil.....14. **paulistus** n.sp.

1. **Aenasius frontalis** n. sp. (Figures 2-3).

The most distinctive characters of this species are the slightly ledge-like anterior margin of the frons which is carinated at meeting the facial impression; a slight inflexion of the forewings on the posterior margin, just beyond distal end of the thickened edge which guides the hooklets; hairless, hyaline break on the costal margin of the blade just beyond apex of the postmarginal and stigmal veins; ocelli in an equilateral triangle.

Female.—Head bright blue-green to violaceous; facial impression dominantly green, highly refringent, and almost polished, black and more opaque in proximity to the mouth. Thorax and abdomen metallic black to brownish; pronotum faintly bluish. Apex of scape and first four or more funicle joints testaceous. the remainder of the antennae blackish with slight metallic reflections on the scape. All coxae blackish, remainder of the legs light brown. Forewings strongly embrowned on the basal half, fading towards the apex.

Scape widely expanded below, about one and one-half times as long as wide (9:7) and much wider than the club (7:4). Sides of face steeply declivous, finely transversely aciculated, smoother than in the other species. Two rows of coarse punctations descending between the inner anterior orbits and upper part of the facial depression but not extending to the sulci. Marginal and postmarginal veins very narrowly separated from the costal margin; stigmal vein narrowed at the apex and as long as the marginal and postmarginal veins. Postmarginal vein with a large seta at apex. Anterior margin of forewings with a short, transverse, hairless, hyaline break just beyond apexes of postmarginal and stigmal veins. Marginal fringe on the distal anal curvature composed of short, curved cilia.

Axillae separated by a distance almost equal to their greatest length. Median longitudinal line at base of scutellum reduced to a faint, short impression hardly perceptible. Length, 1.8 mm.

Described from 3 females, holotype and paratypes, collected by D. T. Fullaway at Ancon, Taboga, and Montelirio, Panama, March and July, 1924.

2. **Aenasius advena** n. sp. (Figures 1, 2, 3.)

In this species three rows of coarse punctations descend between the inner anterior orbits and upper part of the facial depression and extend almost to the genal sulci; mesopleura finely reticulate punctate, appearing granular under low magnification; ocelli in an equilateral triangle.

Female.—Head bright, metallic green, distinctly bronzy in proximity to the anterior ocellus. Pronotum violaceous to bluish black and much brighter than the mesoscutum, axillae, and scutellum. Abdomen dark metallic. Sides of thorax aeneous. Tarsi, except the apical joints, testaceous, remainder of the legs blackish. Apex of scape and first four funicle joints testaceous. Forewings deeply embrowned on basal half becoming hyaline near the apex.

Scape almost twice as long as wide, as wide as the club. Submarginal and marginal veins separated by a distinct hyaline break. Stigmal vein slightly swollen at apex, about as long as the marginal and postmarginal veins united. Postmarginal vein without a large seta at apex and the marginal fringe on the costa continuous from the apex of postmarginal vein. Mandibles bidentate. Axillae closely fused with the scutellum, the sutures hardly discernible. Length, 2 mm.

Male.—Face and cheeks with greenish-blue reflections, remainder of head and body black; tarsi dirty white to brownish; the apical joints dusky. Wings hyaline. Frontovertex fully one-third as wide as the head; ocelli in a strongly obtuse triangle; umbilicate punctations small and numerous, about seven or eight irregularly placed across narrowest part. Antennae shown in figure 1.

Described from 12 females and 8 males, holotype, allotype, and paratypes, collected and reared by O. H. Swezey from *Pseudococcus virgatus* Ckll., Koko Head and flats west of Makapuu Head, Oahu, Territory of Hawaii, February and March, 1934.

3. **Aenasius ianthinus** n. sp. (Figure 3).

This form, represented by a single female, may prove to be a variant of the foregoing species. Structurally it does not appear much unlike *A. advena* n. sp., but the coloration of the head is conspicuously different.

Female.—Frontal aspect of the head dominantly bright purple; mixed bluish green and purple reflections in the facial impression except bordering the mouth which is black. Frontovertex bluish green near the anterior ocellus. Pronotum bluish green blended with violaceous. Mesoscutum, axillae, and scutellum black with violaceous reflections predominant. Femora and tibiae of middle legs light brown to fuscous.

The punctations on the anterior frons are coarse and close together appearing more as if formed by raised lines than by thimble impressions, in this character differing from the other species.

Described from 1 female, holotype, reared by D. T. Fullaway from *Pseudococcus virgatus* Ckll., at Panama, July, 1924.

4. Aenasius chapadae Ashmead.

Aenasius chapadae Ashmead, Proc. U. S. Nat. Mus., Vol. 22, page 371, 1900.

Habitat: Chapada, Brazil.

5. Aenasius punctatus n. sp. (Figures 2, 3).

The comparatively coarse reticulate punctations on the sides of the thorax combined with bright coloration readily distinguish this species.

Female.—Head, pronotum, prepectus, anterior dorsal margin of the mesopleura, and dorsum on sides of the propodeum dominantly metallic blue. Mesoscutum, axillae, and scutellum with blended bluish and violaceous reflections. Tegulae brown to blackish. Abdomen dark violaceous except the reticulate punctate areas on sides near the base where bluish predominates. Mesopleura posteriorly and ventrally violaceous. Facial impression greenish. Antennae black. Legs dark brown to blackish; tarsi of middle and hind legs, except the apical joints, brown. Forewings embrowned from the base to near the apex, the embrowned pattern about like that of *A. paulistus* as shown in figure 4.

Head, vertical position, dorsal aspect, about five times as wide as long (3:16); frontovertex one-fourth the head width; ocelli in a right angle, the posterior pair touching the orbits and one-half their diameter from the occiput; four irregular rows of umbilicate punctations on the narrow part of the frontovertex. Head, vertical position, frontal aspect, about as wide as high. The umbilicate punctations which descend in two rows along the inner orbits stop short of the genal sulci; cheeks finely reticulate punctate except towards the sides where the reticulations become shortly striate; the median space between the antenna sockets sculptured similar to the cheeks; the scrobes less coarsely sculptured and greenish in contrast to the bluish cheeks.

Scape widely expanded, less than twice as long as wide (21:12); the ventral expansion gradually increasing in width towards the apex. Pedicel slightly longer than wide. Funicle joints transverse, all gradually increasing in size, all about three times as wide as long, the sixth twice as wide as the first. Club about one and one-half times as long as wide, about as wide as the length of the six funicle joints combined. Length, 1.4 mm.

Described from 3 females, holotype and paratypes. Two of the

specimens were reared from *Phenacoccus* sp. collected by H. Compere on *Tibouchina granulosa,* Orchidarum, São Paulo, Brazil, November 5, 1934, and the other specimen captured near this host and on the same plant.

6. Aenasius caeruleus Brues.

Aenasius caeruleus Brues, Bul. Amer. Mus. Nat. Hist., Vol. 28, page 84, 1910.

Habitat: Vera Cruz, Mexico.

7. Aenasius hyettus (Walker) (Figures 1, 2, 3).

Encyrtus hyettus Walker, Ann. Mag. Nat. Hist., Vol. 17, page 181, 1846.

Aenasius hyettus Howard, Jour. Linn. Soc. Zool., Vol. 25, page 89, 1894. Jour. Linn. Soc. Zool., Vol. 26, page 146, 1896.

In 1846, Francis Walker described a species from St. Vincent's Island, British West Indies, as *Encyrtus hyettus,* and in a separate paragraph stated: "This species may be considered as the type of a new genus, for which I propose the name *Aenasius.*" In his report on the parasitic Hymenoptera of the Island of St. Vincent in 1894, Dr. L. O. Howard recognized and described a species as *Aenasius hyettus* (Walker). Howard stated that he had little or no doubt concerning the accuracy of his identification. In 1896 Howard identified some specimens from the Island of Grenada as *A. hyettus.* In the collection of P. H. Timberlake is a series of 17 females and 34 males from Panama which appear to be specifically similar to a female and male of the Grenada samples determined by Howard in 1896 as *A. hyettus* Walker. The specimens from Panama, as well as the Grenada samples, are not in entire agreement with either the original description by Walker nor the redescription by Howard, especially in regard to the wing venation. In the original description Walker stated: ". . . humerus (submarginal) much less than half the length of the wing; ulna (marginal) about one-third of the length of the humerus (submarginal); radius (postmarginal) short; cubitus (stigmal) long, not much shorter than the ulna (marginal); stigma very small." Howard described the venation as follows: ". . . submarginal vein short; marginal vein very

short, almost wanting; stigmal vein rather long, slender, very slightly curved. . . ."

Walker's and Howard's descriptions relative to wing venation are not in agreement, nor does either of these descriptions fit the specimens identified as *Aenasius hyettus* (Walker) in this paper. Except for this discrepancy, the available evidence indicates that Howard recognized Walker's species correctly, and that the species from Panama is similar to the Grenada and St. Vincent species.

The males were first described by Howard in 1894. It has already been pointed out that in the male sex *Aenasius hyettus* (Walker) differs rather strikingly from the other species which are represented by male specimens. Although some encyrtid genera have been erected on the basis of male characters which differ less than those separating *A. hyettus* from some of the species assembled here, no practical purpose will be served by subdividing the group on the basis of male characters when the females do not present comparable differentiating characters.

Female.—Metallic coloration variable. Generally the frontovertex bluish green, often with an admixture of violaceous and faintly greenish in some specimens. Facial impression usually more brilliantly green than the frontovertex and often partly blue or violaceous. Apparently any blend of these colors may appear. Pronotum slightly more bluish than the mesoscutum. Mesoscutum, axillae, and scutellum black with faint bluish, greenish, or violaceous reflections or almost non-metallic. Sides and under parts of thorax and abdomen black. Antennae black. Legs black to brown, the brown on the distal part of the posterior femora, middle femora, and tibiae and tarsi except the apical joints. Spur of middle tibiae fuscous. Forewings strongly embrowned.

Frontovertex slightly narrower than in most species, at the narrowest part a trifle less than one-fourth the greatest head width; orbits diverging anteriorly and posteriorly from the anterior ocellus; ocelli in an acute triangle. Four irregular rows of large, shallow, umbilicate punctations across the narrow part of the frontovertex; two rows of coarse, umbilicate punctations descending between the anterior orbits and facial impression; the coarse punctations fade out at the abrupt change of angulation between the frontal and lateral planes of the head. Facial impression deep with steep sides, almost carinated at junction with the frons. Mesopleura almost smooth anteriorly. Lateral margins of scutellum faintly reflexed, the so-called "rim" of Walker's and Howard's descriptions, a character common to most species. Scutellum tessellate, reticulate, at base with a short, median, longitudinal depressed line. Axillae narrowly separated; axillar-scutellar sutures faint. Mandibles bidentate.

Antennal scape one and one-half times as long as wide. Club relatively small, slightly longer than wide and one-half as wide as the scape.

Forewings deeply embrowned at the base, gradually fading towards the apex. Marginal vein about one-sixth the length of the submarginal vein and slightly shorter than the postmarginal vein; postmarginal vein extending as far distad as the stigmal vein; stigmal vein slightly and gradually widening towards the apex, marginal and postmarginal veins narrowly separated from the costa. Costa beyond the distal end of postmarginal vein with marginal cilia; a small, hairless, hyaline area distad of the termination of the postmarginal and stigmal veins. Hind wings with a distinct, short, spur-like basal vein projecting inward from the downward bend at the junction of the submarginella and marginella (fig. 3). Length, 1.5 mm. to 2.0 mm.

Male.—Darker in color than the female. Dorsum of thorax faintly metallic; frontovertex violaceous; face dominantly dark greenish blue. Legs mostly black with a faint admixture of brownish on the middle tibiae and to a less extent on middle femora and at apex of hind femora; tarsi brown to fuscous; testaceous on the basal part of the basitarsus of the middle and hind legs. Forewings hyaline.

Frontovertex twice as long as wide and less than one-third as wide as the head; ocelli in an acute triangle. From four to five rows of irregular, coarse, umbilicate punctations across the frontovertex anterior to the median ocellus. Antennae as shown in figure 1.

Postmarginal vein much longer than the marginal vein and reaching distad much further than the stigmal vein. Length, 1.2 mm. to 2.0 mm.

Redescribed from 17 females, 34 males collected by D. T. Fullaway at various localities in Panama, 1924, and from 1 female and 1 male collected by H. H. Smith, Balthazar, Windward side, Grenada, W. I. The Grenada specimens determined by L. O. Howard as *A. hyettus* (Walker).

8. **Aenasius maplei** n. sp. (Figures 1, 3).

Female.—Dominantly black; frontovertex, temples, cheeks, and pronotum mostly greenish blue; the punctations on the frontovertex, between the median ocellus and facial impression, highly polished and with brassy reflections. Mesoscutum, axillae, and scutellum shining, almost nonmetallic. Basitarsus of middle and hind legs dirty white, the remainder of tarsi brown to fuscous. Antennae completely black. Forewings deeply embrowned, pale towards the apex.

Frontovertex at narrowest part almost one-third the head width; ocelli in a right angle; three more or less distinct rows of coarse, umbilicate punctations descend between the anterior orbits and the facial impression. Facial impression deep with steep sides. Mesoscutum, axillae, and scutellum finely punctate reticulate. Scutellum almost plane, at the

base a short, longitudinal, median, impressed line. Axillar-scutellar sutures faint.

Scape about as shown in the figure of *A. hyettus:* one and one-half times as long as wide; club less than one and one-half times as long as wide, and narrower than the scape (10:13).

Marginal vein rather short, not much more than twice as long as wide, plainly shorter than the postmarginal vein; postmarginal vein not reaching as far distad as the stigmal vein; a hyaline, hairless break just beyond the apex of postmarginal and stigmal veins. Length, 1.8 mm.

Male.—Black, only the proximal part of the basitarsus of the middle and hind legs dirty white. Frontovertex granularly punctate reticulate without coarse, umbilicate punctures. Facial impression not contiguous with the orbits above. Length, 1.4 mm.

Described from 2 females and 4 males, holotype, allotype and paratypes, reared from *Puto yuccae* Coq. collected at Santa Paula, California, by John D. Maple, April 30, 1935.

9. Aenasius brasiliensis (Mercet).

Chalcaspis brasiliensis Mercet. Eos, Rev. Espan. Entom. Vol. 2, No. 1, page 46, 1926.

This species described from Brazil appears from the description to be closely related to *A. paulistus* n. sp. in many respects. According to the description and figure given by Mercet, the mesoscutum has sparse setiferous punctures, and in contrast the scutellum is coarsely punctated. In all the species at hand the scutellum is not any more coarsely punctate than is the mesoscutum. The light brown apical half of the club and blue tegulae will also aid in the identification of this species.

Habitat: Corumba, Brazil.

10. Aenasius longiscapus n. sp. (Figures 2, 3).

Female.—Frontovertex metallic blue green to violaceous, blackish in proximity to the ocelli. Thorax and abdomen shining black, faintly violaceous in parts; the pronotum slightly bluish. Scape testaceous except narrowly at base which is black; pedicel black; first five funicle joints testaceous; sixth funicle joint and club black. Legs blackish to brown, the basitarsus of middle legs almost colorless; apex of middle and hind femora brown, corresponding tibiae brown blended with fuscous; tarsi light brown, the apical joints fuscous. Forewings deeply infuscated on the basal part, paler towards the apex.

Frontovertex at narrowest part about one-third the head width with

approximately eight irregular rows of coarse, umbilicate punctations; three rows of umbilicate punctations descend between the anterior orbits and facial impression; ocelli in a slightly obtuse triangle. Mesoscutum about one-half as long as the scutellum and hardly longer than the width of the frontovertex. Submarginal vein with the ventral margin towards the apex expanded and merging into the deep infuscation of the blade; postmarginal vein a trifle shorter than the stigmal vein, the latter with a long seta at apex; a short, narrow, hyaline, hairless break at apex of postmarginal and stigmal veins. Antennal scape more than four times as long as wide (22:5), the greatest width proximad of the center; club large, twice as long as wide, longer than the pedicel and funicle united, and slightly shorter than the scape. Length, 1.4 mm.

Described from 1 female, holotype, captured by H. Compere at Campinas, Brazil, November 26, 1934.

11. Aenasius cariocus n. sp. (Figures 2, 3).

Female.—Frontovertex bright purplish blue, ocellar area violaceous black; facial impression brassy green, blackish above the mouth and between the sockets; thorax and abdomen black, faintly violaceous. Distal ends of front tibiae, most of middle femora and tibiae, hind femora at distal ends, and most of hind tibiae and all tarsi light brown; tibial spur of middle legs blackish. Basal part of forewings infuscated as far distad as the outer margin of the speculum. Dorsal and ventral margins of the scape on basal two-thirds blackish; pedicel, sixth funicle joint, and club black.

Frontovertex at narrowest almost one-third the head width (6:21); five irregular rows of coarse, umbilicate punctations on narrow part of frontovertex and two rows of coarse punctations, in addition to the orbital rows of smaller punctations, descending between the anterior orbits and facial impression; ocelli in a right angle. Scutellum one and one-half times as long as the mesoscutum. Wing venation about like that of *longiscapus* n.sp. Antennal scape widest at the middle, less than four times as long as wide (21:6); club about one and one-half times as long as wide and about as long as the six funicle joints. Length, 1.4 mm.

Described from 1 female, holotype, captured by H. Compere at Campinas, Brazil, November 26, 1934.

12. Aenasius pacificus n. sp. (Figure 3).

Female.—Frontovertex mostly black metallic blending to bluish green anteriorly; facial impression and cheeks mostly metallic bluish green; blackish near the mouth. Ventral margin of scape narrowly on the basal third and pedicel dark brown or blackish. Club testaceous on the inner face, the outer face more or less brownish. Thorax and abdomen mostly

black metallic, the sides and underparts of the former tending to dark brown. Tarsi and most of tibiae brown, the latter more or less suffused with fuscous on the outer aspect of the basal half or so; femora mostly fuscous, brownish towards the apical ends. Forewings embrowned, dark towards the base and fading towards the apex.

Frontovertex, at narrowest part, almost one-third as wide as the head (11:37); ocelli in a right triangle, the median ocellus twice its own diameter from the orbits; four irregular rows of large, shallow, umbilicate punctations anterior to the median ocellus; the setae which arise from the center of each umbilicate punctation about as long as the diameter of the punctation. Two rows of coarse punctations descending between the anterior orbits and facial impression. Mesoscutum hardly longer than the width of the frontovertex. Axillae slightly separated, the axillar-scutellar sutures hardly perceptible; scutellum with a short, median, longitudinal impressed line at base. Marginal vein hardly twice as long as wide; postmarginal vein twice as long as the marginal vein; stigmal vein extending distad further than the postmarginal vein; a hyaline, hairless break just beyond the ends of the postmarginal and stigmal veins. Antennal scape slightly expanded, almost four times as long as wide (15:4), widest at the middle; pedicel about twice as long as wide; first three funicle joints almost subequal, the last three very appreciably increasing in width. Club large, about twice as wide as long, plainly wider than the scape and as long as the pedicel and funicle joints united. Length, 1.6 mm.

Described from three females, holotye and paratypes, collected by H. H. Keifer at Magdalena and Maria Madre islands, Tres Marias, May 17, 19, 1925.

13. Aenasius insularis n. sp. (Figure 3).

Female.—Upper part of facial impression bright bluish green, the frontovertex somewhat darker, partly violaceous, and the punctations partly brassy. Mesoscutum, axillae, and scutellum bluish black. Scape blackish at the base and on the ventral expansion for two-thirds the length, the apex and dorsal thickened part except at base testaceous; pedicel blackish; funicle joints testaceous; base of club blackish, the apical two-thirds or so testaceous. Legs mostly light brown or testaceous with blends of dark brown to fuscous. Forewings lightly embrowned basally, broadly hyaline towards the apex; the embrowned cloud curving outward and downward from the stigma to the apex of the thickened edge on the posterior margin.

Frontovertex at narrowest part slightly more than one-fourth the head width (11:41); ocelli in a right triangle; the median ocellus about one and one-half times its own diameter from the orbits. Facial impression shallow with slightly sloping sides, broadly semicircular above and narrowly separated from the orbits. Face without coarse, umbilicate punc-

tations between the orbits and the impression, the coarse punctations fading out just below an imaginary line drawn tangent to the upper margin of the facial impression. Axillae only slightly separated at inner tips. Scutellum with a distinct, short, median, longitudinal line at base. Postmarginal vein almost twice as long as the marginal vein and reaching further distad than the stigmal vein; costal margin of forewings abruptly reflexed at apex of costal cell; without a hyaline, hairless break beyond the apex of postmarginal and stigmal veins. Antennal scape moderately expanded about three times as long as wide; pedicel one and one-half times as long as wide; ring joint almost one-half the size of the first funicle joints; funicle joints all increasing in width, the sixth about four times as wide as long; club large, twice as long as wide, longer than the pedicel and funicle joints united and a trifle wider than the scape. Length, 1.6 mm.

Described from four females, holotype and paratypes, collected by H. H. Keifer at Magdalena and Maria Madre islands, Las Tres Marias, Mexico, May 17, 19, and 20, 1925.

14. Aenasius paulistus n. sp. (Figures 3, 4).

In some respects this species appears suspiciously like the one described by Ashmead in 1900 from Brazil. However, even when allowance is made for the possibility that Ashmead used a hand lens instead of a microscope when preparing his description, there remain reasons to consider this form as different. In this species the mesoscutum and scutellum are tessellate reticulate with faint setigerous punctures, and under no magnification does the mesoscutum appear to have thimblelike punctations similar to those on the head. Also, the scutellum in this species is only slightly longer than the mesoscutum. Ashmead described *A. chapadae* as having the thorax similar to *A. hyettus* (Walker) except that the mesonotum has the thimblelike punctation similar to that of the head but less distinctly impressed; the scutellum is twice as long as the mesoscutum with the punctation almost obsolete.

Female.—Frontovertex metallic blue-green; facial impression dominantly greenish; thorax above faintly bluish black, the pronotum more refringent and bluish; sides and under parts of thorax and the abdomen shining black. Scape on basal half and on ventral margin to apex, pedicel and most of club blackish; apical portion of scape, funicle, and apex of club testaceous. Legs black to brown; femora and tibiae of middle and hind legs, especially towards the distal ends, diluted with brown; all tarsi brownish. Forewings embrowned as shown in figure 1.

Frontovertex at narrowest less than one-third the head width (8:28); four to five irregular rows of coarse, umbilicate punctations anterior to the median ocellus; ocelli in a right triangle; between the anterior inner orbits and facial impression the coarse punctations fade out just below an imaginary line tangent to the upper part of the facial impression. Facial impression shallow with wide, gently sloping sides, widely semicircular above and closely approaching the orbits. Scape almost two and one-half times as long as wide, moderately expanded; pedicel one and one-half times as long as wide; ring joint large and furnished with setae, asymmetrical, except for smaller size not unlike a funicle joint; the six funicle joints successively increasing in width so that the sixth is four or five times as wide as long; club almost twice as long as wide and as long as the pedicel and funicle together. Mandibles tridentate, a small, upper, inner tooth easily overlooked. Scutellum slightly longer than the mesoscutum. Axillae slightly separated. Length, 1.2 mm.

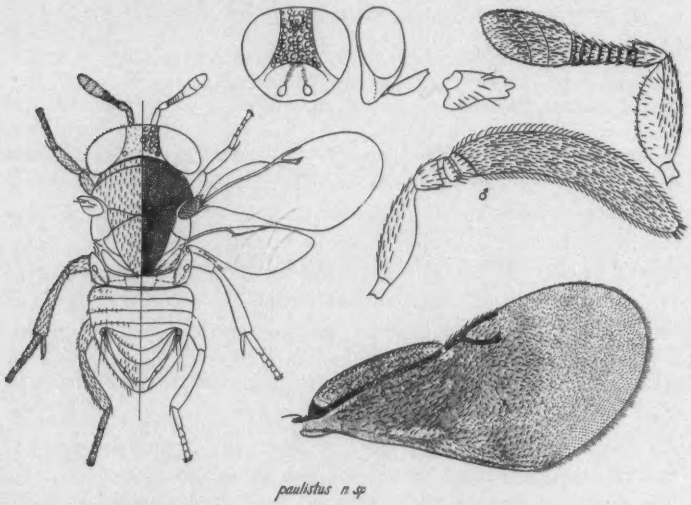

Fig. 4.—*Aenasius paulistus* n. sp., female, body, head, mandible, antenna, and wing; male, antenna.

Male.—Entirely black except most of the tarsi, apex of middle tibiae, and slightly at apex of middle femora which are brown; apical tarsal joints dusky.

Antennae composed of five joints; scape, pedicel, two short transverse funicle joints, and a greatly elongated, thick, compressed, densely setose club. Frontovertex with smaller, shallower, and more numerous punctures than in the female. Head slightly lenticular; frontovertex longer than wide (4:3); ocelli in a right triangle, the posterior pair almost touching

the orbits and narrowly separated from the occipital margin. Forewings without an embrowned pattern. Length, 1.2 mm.

Described from 2 females and 4 males, holotype, allotype, and paratypes, propagated on *Pseudococcus maritimus* (Ehrh.) by S. E. Flanders in the quarantine room of the insectary of the Citrus Experiment Station at Riverside. The males are the progeny of the females. Flanders reared three females from a *Pseudococcus* sp., obtaind in a shipment from Brazil, which he determined as *P. maritimus* (Ehrh.). Although this *Pseudococcus* has the usual diagnostic characters of *P. maritimus,* it is not that species but one which looks almost exactly like *P. gahani* in life. It is being described as a new species by Edson Hambleton. This mealybug was found lightly infesting *Hedera helix* at Avenida Paulista, São Paulo, Brazil. In addition to the series of type specimens which are definitely correlated with the host, two females and two males were captured in the open near this *Pseudococcus.*

Attempts to import *Aenasius paulistus* n. sp. into California, through the cooperation of Edson Hambleton, are being made for its possible use against *Pseudococcus maritimus* (Ehrh.).

SUPPLEMENTARY NOTE

After completion of the paper on the classification of the species of *Aenasius,* a small collection of mealybug inhabiting parasites was received for identification from Dr. Walter Carter, Experiment Station, Pineapple Producers' Cooperative Association, Ltd., Honolulu, Hawaii. Among them were the following two species of *Aenasius* which were imported into Hawaii from Colombia to be used in the attempt to control *Pseudococcus brevipes* (Ckll.) in the Islands by biological methods.

Aenasius colombiensis n. sp.

The principal diagnostic characters of this form are the same as those of *cariocus* Compere: namely, scape more than two and one-half times as long as wide; scutellum with fine tessellate reticulations and setiferous punctation no coarser than on the mesoscutum; tegulae blackish; femora and tibiae more or less brown; umbilicate punctations in two irregular rows between the inner anterior orbits and facial depression and descending almost to the genal sulci; forewings with a small, hairless hyaline streak distad of the stigmal and postmarginal veins; postmarginal vein not extending as far distad as the stigmal vein; ocelli in a right triangle;

frontovertex at narrowest with four or five rows of irregularly placed, coarse, umbilicate punctations; forewings triangular, not markedly reflexed on the outer anal curvature.

This form differs from *cariocus* in color. In *cariocus* the first five funicle joints are testaceous, the sixth blackish; scape testaceous except the dorsal and ventral margins on the basal two-thirds which are blackish.

Female.—Frontovertex black metallic with violaceous and greenish reflections, the ocellar area less refringent; facial impression and cheeks slightly green. Thorax and abdomen black, metallic. Sides of scape more or less longitudinally streaked with brown towards the apex, remainder of scape, pedicel, club, and more or less of the first four funicle joints blackish.

Legs dominantly black, marked with more or less brownish as follows: all tarsi except the apical joints; distal ends of middle and hind femora faintly suffused; tibiae of middle and hind legs faintly suffused on the sides. Tibial spur blackish.

Male.—Very similar to *hyettus* (Walker). The most apparent differences are that in this form the forewings are embrowned beneath the venation as far distad as the speculum, the marginal vein is less than twice as long as wide and about one-half as long as the postmarginal vein. In the male sex of *hyettus*, the forewings are not embrowned; the marginal vein is about thrice as long as wide and about one-half as long as the postmarginal vein. The antennae are very similar to those of *hyettus*.

Described from 17 females and 15 males, holotype, allotype, and paratypes, reared from a species of *Pseudococcus* collected by E. G. Salas at Barbosa, Colombia, October, 1935.

Aenasius cariocus Compere.

Ten females, reared from *Pseudococcus* sp. are referred to this species. They were collected by E. G. Salas at Bucaramanga, Colombia, September, 1935, and reared by Carter at Honolulu.

Notes on the Taro Leafhopper (Megamelus proserpina Kirk.) (Delphacidae).

BY D. T. FULLAWAY

Board of Agriculture and Forestry

(Presented at the meeting of August 6, 1936.)

This destructive insect, which was believed to be eradicated at Waianae in 1930, has reappeared and is now doing considerable damage to the taro planted on the lands of the John Ii Estate and the Bishop Estate makai of King St. and ewa of Kalakaua Ave., Honolulu. It is apparently confined to a very small acreage and eradication will again be attempted. Considerable mystery surrounds its occurrence here and a satisfactory explanation is still awaited.

In view of the determination to attempt its eradication in both instances of its appearance here, there has been no opportunity to make life-history studies of the insect in these islands, but such an opportunity was embraced on the occasion of a visit to the Philippine Islands in 1931, and the notes then made are now offered for publication.

The eggs are small (less than 1 mm. long), spindle-shaped with pointed ends, pearly white. They are deposited principally in the stems in cavities hollowed out in the soft cellular tissue. Most cavities exposed contained two eggs. The eggs hatch in 8 to 9 days (at Laguna, P. I., in September). The nymph thus hatched is very tiny but develops rapidly and in 13 days becomes an adult insect, several millimeters long. Only four moultings were observed during this process of growth, occurring at 3-4 day intervals. All the adults collected in September at Laguna were short-winged forms, the same as those at Waianae. Long-winged forms were shown me by Prof. Uichanco of the Agricultural College. It was observed at Laguna that the egg-tubes in the female were fully developed three days after the adult state was reached. The proportion of the sexes was about

equal. Copulation is believed to take place at night. The leafhopper was not found on any other plant than the cultivated taro. The species is heavily parasitized in the Philippines. The parasites observed there were *Paranagrus perforator, Ootetrastichus* sp. (a different species from either *beatus* or *formosanus*) and a dryinid. When the insect was first seen at Waianae by Swezey and myself it was being attacked by a dryinid and *Cyrtorhinus*.

Susceptibility of Two Tomato Varieties To Infestation By Chaetodacus cucurbitae (Coq.)

BY RALPH H. MARLOWE
Junior Entomologist, Bureau of Entomology and Plant Quarantine

(Presented at the meeting of December 3, 1936)

Recently some work was completed on a field technique that may be employed to measure the effectiveness of a bait spray on melon fly populations. The experimental plot in which the work was carried on contained two commercially grown tomato varieties. Incidentally, it was observed that there was a difference in the infestation of the two varieties grown side by side in the same field. This note presents data which shows that under conditions which existed during the experimental setup, Break of Day variety of tomato was less susceptible to infestation by *C. cucurbitae* than the Prichard variety.

The experimental field was composed of two sections, i.e., south side, Break of Day variety—112 plants, 6 rows wide and the north side, Prichard variety—49 plants, 4 rows wide. The prevailing winds were along the field and not across from one variety to the other thus reducing to a minimum the cross drift of flies.

The crop was picked and infestation counts recorded weekly. Ripe (colored) tomatoes were inspected at the time of picking. The mature green tomatoes were held for 3 to 4 days before examining for infestation. The following table gives the number of tomatoes picked, percent infested by *C. cucurbitae* and the percent injured by other agents which includes tomatoes that were not infested by the melon fly but were not marketable because of injury due to rodents, birds, diseases and other insects besides the melon fly.

The plants in the Break of Day section produced tomatoes for two weeks longer than the Prichard variety. The average number of fruits per plant was 93+ and 46+ respectively or an approximate ratio of 2 to 1. Of the total crop, the average infestation by

Infestation of two Varieties of Tomatoes by *C. cucurbitae.*

Date 1936	Prichard			Break of Day		
	Number tomatoes picked	Percent infested by *C. cucurbitae*	Percent injured by other agents	Number tomatoes picked	Percent infested by *C. cucurbitae*	Percent injured by other agents
8- 3	80	70.0	6.3	473	18.6	8.0
8-10	147	83.7	3.4	367	25.1	9.8
8-17	127	57.5	26.0	303	14.2	12.2
8-24	320	64.4	23.1	952	5.8	9.5
8-31	864	49.3	37.0	2,208	17.0	8.5
9- 8	540	40.0	42.0	1,701	25.2	15.4
9-14	180	50.0	32.8	978	26.4	22.7
9-21	.....	.....	.....	1,350	21.6	32.2
9-28	.....	.....	.....	2,166*	19.7	36.3
Total	2,258	59.3	24.4	10,498	19.3	17.2

the melon fly of the Break of Day variety was 19.3 percent as compared with 59.3 percent infestation of the Prichard variety.

Of the 10,498 tomatoes produced by the Break of Day variety, 6,668+ or 63.5 percent were marketable; of the 2,258 produced by the Prichard variety, 369+ or 16.4 percent were marketable. The average yield of marketable tomatoes per plant was 59+ and 7+ respectively, or an approximate ratio of 8 to 1 per plant.

* This figure includes some medium-size green tomatoes which were picked as the plants were pulled up. Ordinarily these immature tomatoes would have been left for another week before being harvested.

Further Notes on Hawaiian Thrips With Descriptions of New Species

BY DUDLEY MOULTON
Redwood City, California

(Presented by Mr. Sakimura at the meeting of December 3, 1936.)

Seven new species of Thysanoptera are added to the fauna of the Hawaiian Islands in this paper and three others, *Taeniothrips frici* Uzel, *T. gracilis* Moulton and *Thrips nigropilosus* Uzel are listed as having been found here for the first time. I am especially indebted to Mr. K. Sakimura for his keen interest in these insects and for supplying me with the material for study.

Family THRIPIDAE Uzel, 1895
Subfamily SERICOTHRIPINAE Karny
Tribe SERICOTHRIPINI Priesner

Scirtothrips antennatus Moult., new species.

Female holotype: Color uniformly clear light yellow except antennal segments five to eight which are grayish brown; wings clear with only veins showing darker.

Total body length .926 mm.; head length .073 mm.; width .140 mm. Segments of antenna: length (width) I, 16 (16); II, 23 (23); III, 26 (15); IV, 26 (16); V, 30 (16); VI, 33 (13); VII, 6; VIII, 9; total, 166 microns.

Head approximately twice wider than long; eyes prominent, slightly protruding, occupying fully half the side of the head; cheeks somewhat arched; without prominent spines. Mouth cone rather pointed, reaching two-thirds over prosternum. Antenna with first segment small and almost square, two globular, three and four oblong pedicellate, five and six broadly and evenly joined, with sixth longest; style about half as long as segment six.

Prothorax transverse, with a single short, moderately stout spine at each posterior angle. Legs normal. Wings fully developed; forewings with two distinct veins, each with a few scattering and irregularly placed, very inconspicuous spines.

Abdomen normal, without conspicuous spines, those at tip extremely short.

This species might have been placed in the genus Anaphothrips, but the rather prominent and protruding eyes, together with the

shape of the antennal segments five and six would seem to exclude it from this genus. It is particularly distinctive because of the shape of these two segments. They are closely joined and segment six is semi-cone shaped, narrowing gradually from the broad base.

Described from two specimens, taken on Panax hedge at Kakaako, Oahu, on September 26, 1930, by I. Yanagihara. Holotype in author's collection, paratype deposited in the collection of the Pineapple Experiment Station, Honolulu. (Moulton No. 5394.)

Subfamily THRIPINAE Karny

Taeniothrips frici Uzel.

Specimens collected from dandelion at Olinda, Maui, on August 31, 1933, by M. B. Linford. This is the first record of the finding of this species in the Hawaiian Islands.

Taeniothrips gracilis Moulton.

Specimens collected by K. Sakimura on *Hymenocallis declinata* August 11, 1930. This is also a first record for the Hawaiian Islands.

Taeniothrips alliorum Priesner

This species was described by the writer as *Taeniothrips carteri* but a comparison with specimens from Japan taken on onions, the same host plant, indicates that *carteri* must fall as a synonym of *alliorum*.

Thrips nigropilosus Uzel.

Specimens taken on lettuce leaves at Kapahulu, Oahu, in June, 1936. This, too, is a new record of distribution for this insect.

Isoneurothrips fasciatus Moulton, new species.

Female holotype: Color yellowish brown including antennae and legs except all tarsi and tips of tibiae which are yellow; forewings yellow but banded with brown in the middle and at tip, very similar to *Hercothrips fasciatus*.

Total body length .823 mm.; head length .083 mm.; width .156 mm.; antennal segments length (width), III, 33 (20); IV, 33 (20); V, 28 (16); VI, 40 (16); VII, 16 microns.

This species is distinctive from others in the genus because of

the banded wings. There are four small spines along posterior margin of prothorax inward from the angle spines; the comb bordering posterior margin of eighth abdominal segment is complete but short.

Described from a unique specimen taken in a wind trap, October 18, 1935, at Kipapa, Oahu, by W. Carter. Holotype in author's collection. (Moulton No. 5395.)

Isoneurothrips carteri Moulton, new species.

Female holotype: Color uniformly clear yellow including first two antennal segments; three to seven abruptly and uniformly brown; all prominent body and wing spines brown.

Total body length 1.12 mm.; antennal segments length (width), III, 30 (20); IV, 30 (18); V, 23 (16); VI, 36 (16); VII, 20 microns.

Head transverse; interocellar spines placed between posterior ocelli; mouth cone rather pointed reaching across prosternum. Three small spines on either side along posterior margin of prothorax inward from angle pair. Median spines on metanotum placed about sixteen microns back from anterior margin. Comb on posterior margin of eighth abdominal segment complete. Fore vein of forewing with nineteen and hind vein with fourteen regularly placed spines.

This species is very similar in appearance to *williamsi* but easily separated by the shorter and more compact intermediate antennal segments and by the placement of the metanotal spines, in *williamsi* these are near the anterior margin of the segment while in this new species they are placed well back from the margin.

Described from a single specimen taken in a wind trap at Kipapa, Oahu, June 1, 1934, by W. Carter. I take pleasure in naming this species after the collector. Holotype in author's collection. (Moulton No. 5396.)

Merothrips hawaiiensis Moulton, new species.

Female holotype: Color light brownish yellow with head and first two antennal segments more distinctly yellow, other antennal segments brown; wings washed with brown; crescents of ocelli orange.

Total body length 1.1 mm.; head length .093 mm.; width .09 mm.; antennal segments length (width), II, 26 (23); III, 40 (20); IV, 40 (18); V, 30 (13); VI, 30 (13); VII, 30 (13); VIII, 36 microns.

Head approximately as long as wide, angular in front, cheeks almost straight and parallel; eyes occupying about one-half the length of the head; anteocellar spines equal in length to the first two antennal segments, postoculars somewhat shorter.

Prothorax longer than head, trapezoidal in shape, each fore tibia armed with a small tooth; fore and hind femora enlarged as characterized in the genus; wings fully developed, with two veins, the fore vein with twelve and the hind vein with fifteen spines. Terminal abdominal spines long.

This species differs from *williamsi* Priesner in its smaller head, more slender antennae and by the smaller fore tarsal tooth; *cognatus* has the eyes produced ventrally; in *fusciceps* Hood, the head is 1.5 times as wide as long and the eyes are relatively longer and the antennal segments are much stouter.

Described from two specimens taken in wind traps October, 1935, at Molokai by W. Carter. Holotype in author's collection, paratype deposited in the collection of the Pineapple Experiment Station, Honolulu. (Moulton No. 5397.)

Superfamily PHLOEOTHRIPOIDEA Hood, 1915
Family PHLOEOTHRIPIDAE Uzel, 1895
Subfamily PHLOEOTHRIPINAE Karny, 1921
Tribe HOPLOTHRIPINI Priesner, 1927

Oedemothrips laciteps Bagnall, 1910.

One female specimen taken while sweeping among *Carex oahuensis* March 31, 1935, on Mt. Kaala, Waianae, Oahu, by H. S. Au. (Moulton No. 5398.)

Hoplothrips paumalui Moulton, new species.

Female holotype: Color chestnut brown with tips of fore femora, fore tibiae and all tarsi yellowish; antennal segments one, two and four to eight dark brown with two shading yellowish toward tip and three of lighter brown shading yellowish at base; wings clear.

Total body length (abdomen distended) 2.0 mm.; head length .19 mm.; width .19 mm.; tube length .16 mm. Segments of antenna length (width), II, 50 (33); III, 63 (30); IV, 56 (30); V, 60 (30); VI, 56 (26); VII, 36; VIII, 36 microns.

Head approximately as long as wide, broadly rounded in front, cheeks straight and parallel; eyes large occupying almost one-third the side of the head; ocelli small, posterior pair immediately contiguous with the inner sides of the eyes; postocular spines placed close behind eyes, long and transparent; antennae and mouth parts normal to genus.

All normal spines present on prothorax, long, transparent and with dilated tips. Fore femora only slightly thickened, fore tarsi unarmed. Wings fully developed, with 4-6 double fringe hairs. Tube about eight-tenths as long as head.

This species may be compared with *laticornis* Bagnall but separated by its clear wings (they are smoky in *laticornis*) and by the unarmed fore tarsi. In *laticornis* each fore tarsus is armed with a sharp tooth.

Described from three specimens, the holotype taken on *Emilia sagittata* at Paumalu, Oahu, August 25, 1930, by K. Sakimura, and two paratypes taken in wind traps at Kipapa in 1935 by W. Carter. Holotype in author's collection, paratypes deposited with the Pineapple Experiment Station, Honolulu. (Moulton No. 5399.)

Tribe HAPLOTHRIPINI Priesner

Haplothrips (Hindsiana) sakimurai Moulton, new species.

Female holotype: Color, head, thorax and last two abdominal segments dark brown, eighth abdominal segment brown; basal two-thirds of fore femora brown, otherwise all legs are clear yellow like abdominal segments one to seven; antennal segments one, seven and eight brown, two brown in basal two-thirds, yellowish in distal portion, three clear yellow, four and five yellow shaded brownish in the middle, six yellow at base shading to brown at tip; wings clear.

Total body length 1.3 mm.; head length .156 mm.; width .14 mm.; tube length .113 mm. Antennal segments length (width), II, 40 (26); III, 43 (23); IV, 50 (24); V, 43 (20); VI, 40 (20); VII, 36 (18); VIII, 33 microns.

Head slightly longer than wide, narrowing at the eyes, angular in front, cheeks slightly arched; postocular spines prominent, with dilated tips like other prominent body spines; mouth cone short, rounded, reaching two-thirds over prosternum. Antennae slender, third segment almost symmetrical, fourth and fifth distinctly narrowed at both ends.

Prothorax with all normal spines developed but short. Fore wings without double fringe hairs. Tube .73 as long as head.

This species differs from *williamsi* in its more distinct yellow and brown coloring, more slender antennae and the absence of double fringe hairs on the fore wings; the head also is clearly narrowed in front.

Type material: female holotype and thirteen female paratypes taken from wind traps at Kipapa, Oahu, by W. Carter. Holotype in author's collection, some of the paratypes placed with the Pineapple Experiment Station, Honolulu. (Moulton No. 5400.)

Tribe PHLOEOTHRIPINI Priesner

Phloeothrips claratibia Moulton, new species

Male holotype: Color, head and thorax chestnut brown, abdomen mostly yellow shading to brown toward the tip; legs with all femora brown with yellow at extreme tips and all tibiae and tarsi clear yellow; antennae mostly brown, with segments three, four and five yellowish toward their bases; wings nearly clear in basal half and shaded gray in distal half.

Total body length 1.38 mm.; head length .22 mm.; width .19 mm.; length of fore femora .176 mm.; width .088 mm.; tube length .132 mm. Antennal segments length (width), II, 46 (30); III, 66 (33); IV, 70 (33); V, 66 (26); VI, 53 (23); VII, 43; VIII, 40 microns.

Head broadened somewhat behind eyes, spines on cheeks small, the posterior pair strongest; dorsum with faint though distinct reticulation; eyes large, ocelli placed rather far forward; mouth cone pointed, but rather short reaching three-fourths over prosternum; antennae normal to the genus.

Prothorax with all normal spines present, long and like the postoculars, with dilated tips; fore femora enlarged, neither femora nor tibia armed, each fore tarsus with a small sharp tooth; forewings with ten double fringe hairs. Tube .6 as long as head.

This species may be separated from *mauiensis* Moulton by its shorter mouth cone and smaller fore femora. It might also be compared with *parvus* Uzel but this latter species has the head constricted neck-like posteriorly while in this species the cheeks are nearly straight.

Described from a single made specimen taken in a wind trap by W. Carter on April 26, 1934, at Kipapa, Oahu. Holotype in author's collection. (Moulton No. 5463.)

A Survey of Host Ranges of Thrips in and Around Hawaiian Pineapple Fields[1]

BY K. SAKIMURA[2]
Pineapple Experiment Station

(Presented at the meeting of December 3, 1936)

A survey of host ranges of thrips, in and around pineapple fields, relating to the study of the transmitting vector of the pineapple yellow spot, was undertaken during 1930 and 1931, and incidental data have been collected since. The data on *Thrips tabaci* Lind., the proved transmitting vector (11), were reported (17) and a preliminary report on some other thrips was published (18). All the available data are presented here and their host ranges will be discussed in relation to the disease.

The first revision of Hawaiian Thysanoptera was published by Bagnall (1) in 1910. Since then various local workers sent specimens to Moulton (12, 13, 14, 15) for determination, which has enabled him to publish 4 papers on descriptions of new species. The specimens of new or heretofore unrecorded species collected during the present investigation were also sent to him, and in his last three papers (13, 14, 15) such materials are included. (The writer wishes to express appreciation for Mr. Moulton's cooperation).

MATERIALS AND TECHNIC

Various weeds, shrubs, trees, crop and ornamental plants (301 different samples, comprising 104 species in 36 families) in and around pineapple fields were checked. A fairly good number of other plant samples were found not associated with thrips. The series of host plants presented in this paper well covers the list of principal weeds in pineapple fields surveyed by other workers (16). Special attention was paid to the host range, population, breeding plant, food preference and source of feeding of the thrips. The majority of the samples was collected on Oahu; several, on the other islands. Efforts were exercised to collect dupli-

[1] Published with the approval of the Director as Technical Paper No. 102 of the Pineapple Experiment Station, University of Hawaii.
[2] The present investigation was conducted under the direction of Dr. Walter Carter.

cate samples from different localities or at different times. Plants were collected in the fields, packed in large mailing tubes or bags and brought to the laboratory, where the thrips were shaken off. Thus records of the number by stages (larva and adult) and of the sources of feeding (flower or leaf) were made. Occasionally the ordinary method of collecting with a brush directly from standing plants was practiced.

RESULTS

Little less than 500 lots of thrips specimens were collected and all the available data are presented in Table 1. Table 1 also includes those recorded in the references (1, 12, 13, 14, 15), whose source of specimens is not from the Pineapple Experiment Station collection (20 plants and 9 thrips), but excludes the ones published by the writer (17, 18). However, the species collected on the bark of dead trees, mostly of the suborder Tubulifera, are omitted because they bear little relation to the present topic.

TABLE 1. HOST RANGES OF THRIPS IN AND AROUND HAWAIIAN PINEAPPLE FIELDS, WITH RECORD OF DISTRIBUTION.

Aeolothrips fasciatus (Linn.). Maui.

Onion
Cyathodes tameiameiae *

Heliothrips haemorrhoidalis Bouché. Oahu, Hawaii.

Hibiscus sp.
Croton *
Fuschia *
Metrosideros polymorpha *

Heliothrips rubrocinctus (Giard). Oahu.

Mango
Calophyllum inophyllum
Croton *

Hercothrips femoralis (Reuter). Oahu.

Chrysanthemum sp.
(7 other plants in (18), larva was collected from all plants.)

* Cited from the references 1, 12, 13, 14.

Chirothrips fulvus Moulton. Oahu.

Paspalum orbiculare

Chirothrips mexicanus Crawford. Oahu.

Chloris paraguayensis *

Eragrostis variabilis *

Chirothrips sacchari Moulton. Oahu.

Sugar cane *

Limothrips cerealium Halid. Kauai, Hawaii.

Various grasses *

Scirtothrips antennatus Moulton. Oahu.

Panax

Anaphothrips orchidii (Moulton). Oahu.

Anthurium

Commelina nudiflora *

Anaphothrips swezeyi Moulton. Oahu, Molokai.

(4 other plants in (18), larva was not collected from 1 plant)

Panicum torridum *

Setaria verticillata *

Scolothrips sexmaculatus (Perg.). Oahu.

† *Xanthium canadense*

Psidium sp.*

Frankliniella flavens Moulton. Oahu.

Corn *

Taeniothrips alliorum Pr. Oahu, Molokai, Lanai, Maui, Kauai.

Onion

† *Emilia sagittata*

Taeniothrips frici (Uzel). Maui.

Taraxacum officinale

Taeniothrips gracilis Moulton. Oahu.

Hymenocallis declinata

† Adults only were collected from these plants.

Taeniothrips hawaiiensis (Morgan). Oahu, Lanai, Maui.

† *Tricholaena rosea*
Asparagus
Yucca sp.
† *Tritonia potsii*
Senebiera didyma
Cassia mimosoides
Delonix regia
Leucaena glauca
Alfalfa
Soy beans
† *Waltheria americana*
Dombeya spectabilis
Ipomoea indica
Ipomoea pes-caprae
Ipomoea tuberculata
† *Solanum nodiflorum*
Spathodea campanulata
Tithonia rotundiflora
(11 other plants in (18), larva was not collected from 1 plant)
Canna *
Cotton *
Psidium *
Aster *

Taeniothrips simplex Morison. Oahu.

Gladiolus

Thrips abdominalis Crawford. Oahu.

† *Ipomoea indica*
Lipochaeta integrifolia
(7 other plants in (18), larva was not collected from 1 plant)
Lantana *
Verbesina encelioides *

Thrips nigropilosus Uzel. Oahu, Maui.

Lettuce
Hypochaeris radicata

Thrips panicus Moulton. Oahu, Molokai.
(6 other plants in (18), larva was not collected from 1 plant)
Echinochloa sp.*
Rice *
Sugar cane *

Thrips saccharoni Moulton. Oahu, Molokai, Kauai.
Sugar cane
Panicum barbinode

Thrips tabaci Lind. Oahu, Molokai, Lanai, Maui, Hawaii, Kauai.
† *Tricholaea rosea*
Asparagus
Nicotiana glauca
† *Spathodea campanulata*
Callistephus chinensis
Lettuce
(66 other plants in (17), larva was not collected from 16 plants)
Rose *
Ipomoea indica *

Thrips trehernei Pr. Oahu.
† Pineapple

Isoneurothrips antennatus Moulton. Oahu.
Metrosideros polymorpha *

Isoneurothrips dubautiae Moulton. Oahu.
Delonix regia
Dubautia sp.*

Isoneurothrips fullawayi Moulton. Oahu.
Ipomoea indica
Broussonetia papyrifera *

Microthrips piercei Morgan. Oahu.
† *Delonix regia*
Xanthium canadense

Stulothrips trespinus Moulton. Oahu.
Pandanus sp.
† Panax

Suborder TUBULIFERA

Hoplothrips paumalui Moulton. Oahu.

† *Emilia sagittata*
† *Lantana camara*
† *Paspalum conjugatum*

Aleurodothrips fasciapennis (Frank.). Oahu, Molokai.

(1 plant under the name of *Aleurodothrips* sp. in (18), larva was collected)
Coconut *

Haplothrips flavipes Jones. Oahu.

Acacia koa *
Lantana camara *

Haplothrips fusca Moulton. Oahu, Molokai.

Batis maritima *

Haplothrips gowdeyi (Frank.). Oahu, Molokai, Lanai, Maui, Hawaii, Kauai.

Digitaria pruriens
Tricholaena rosea
Amaranthus albus
Phytolacca acinosa
Senebiera didyma
Cajanus cajan
† *Malva* sp.
† *Ipomoea pes-caprae*
† *Bothriospermum tenellum*
Pluchea indica
(41 other plants in (18), larva was not collected from 7 plants)
Panicum torridum *
Paspalum conjugatum *
Cotton *
Vernonia cinerea *

Haplothrips melaleuca (Bagnall). Oahu, Molokai.

Digitaria sanguinalis
† *Tricholaena rosea*
† *Senebiera didyma*
† *Bothriospermum tenellum*
(6 other plants under the name of *Dolerothrips* sp. in (18), larva was not collected from 3 plants)

Haplothrips (Hindsiana) sakimurai Moulton. Oahu.

† *Emilia sagittata*

Kentronothrips hawaiiensis Moulton. Oahu.

Sugar cane

Phloeothrips claratibia Moulton. Oahu.

† Pineapple

Stephanothrips occidentalis H. & W. Oahu.

Paspalum orbiculare

The major species with a wide host range and high relative population density are *Thrips tabaci, Taeniothrips hawaiiensis* and *Haplothrips gowdeyi.*

Thrips tabaci is polyphagous and feeds on flowers and leaves. It was collected from 74 plants (27 families) of which Compositae and Leguminosae are the predominant families. It breeds on 54 plants, and its biotic potential is very high (17). The general relative population density is high. The most preferred host is onion; large colonies were also found on Cruciferous plants, *Portulaca oleracea, Mimosa pudica, Bothriospermum tenellum,* Solanaceous plants, and several plants of Compositae including *Emilia sagittata.* Pineapple is one of the hosts and the insect also breeds on it, but only incidentally.

Taeniothrips hawaiiensis is polyphagous but a strict flower feeder. It was collected from 32 plants (16 families), but the preferred range seems restricted to Leguminosae and Convolvulaceae. It breeds on most of the plants mentioned above. Graminae and Compositae are not included in the range, although incidental plants were found infested. Pineapple and *Emilia* are not its hosts.

The general relative population density is very high and large colonies were found on the plants of Liliaceae, Cruciferae, Sterculiaceae, Verbenaceae and the two families mentioned above.

Haplothrips gowdeyi is polyphagous and a flower feeder. It was collected from 55 plants (22 families). It feeds on leaves sometimes, this being especially true on Gramineous plants. It breeds on most of the plants mentioned above. The general relative population density is very high and large colonies were found on the plants of Graminae, Chenopodiaceae, Amaranthaceae, Leguminosae, Euphorbiaceae, Sterculiaceae, Convolvulaceae, Cucurbitaceae and Compositae. Pineapple is not its host.

The other species are monophagous or polyphagous but with a smaller range or incidental species. The present distribution of *Aeolothrips fasciatus* seems restricted, and a wide host range, as is known in other lands, has not been found in Hawaii. *Heliothrips haemorrhoidalis* and *H. rubrocintus* have a moderate host range among shrubs and the latter is a common species. *Hercothrips femoralis* has not been found outside of greenhouses. Injurious *Hercothrips fasciatus* (Perg.) has not been reported in Hawaii. Three species of *Chirothrips* and *Limothrips cerealium* are incidental species and feed on Graminae. *Scirtothrips antennatus* is monophagous and common on panax. *Anaphothrips swezeyi* is strictly a feeder of Graminae and is very common on them. *Anaphothrips orchidii, Frankliniella flavens,* and *Scolothrips sexmaculatus* are incidental species and the last is a predator on other minute insects. *F. flavens* is the only species representing the genus *Frankliniella* which includes *F. moultoni* Hood in California, *F.* n. sp. Bagnall in Australia and *F.* sp. in South Africa, all of which are transmitting vectors of the spotted wilt virus in their respective regions. *Taeniothrips alliorum* is rather monophagous and is common on onion. *Taeniothrips frici* and *T. gracilis* are incidental species feeding on flowers. There is only one host at present known for each of the two above, although both have a large host range in other lands. *Taeniothrips simplex* is common but monophagous. *Thrips abdominalis* is a feeder of Compositae flowers but also feeds on the plants of Convolvulaceae and Malvaceae. *Thrips nigropilosus* was first recorded in Hawaii injuring lettuce and was recently collected from a wild host on Mt. Haleakala (6000 ft. above sea level) where it is isolated from cultivated

or populated areas. It appears to be widely distributed and well established in Hawaii. It has a moderate host range in the Pacific Coast region and is known to be injurious to various crops in Europe. It is also distributed in Australia, where an attempt to feed it on tomato for testing its transmitting capacity of the spotted wilt virus failed. *Thrips panicus* is a feeder of Graminae and is common on them. It was frequently observed feeding and breeding on pineapple especially on the seedlings and planting material. *Thrips trehernei* is a very incidental species and was once collected on pineapple. This species is known to have a moderate host range in the Pacific Coast region and its recent introduction from there is suspected. Three species of *Isoneurothrips* are incidental species and more or less specific flower feeders. *Microthrips piercei*[3] is rather monophagous and is common on cocklebur leaves. *Stulothrips trespinus* is common on pandanus flowers. Some evidence suggests that it must have other hosts; however, they are not known with the exception of panax. All of the above belong to the suborder Terebrantia.

Among the suborder Tubulifera, very few are known which feed on the present group of living plants. *Hoplothrips paumalui* is an incidental species and probably a flower feeder. *Aleurodothrips fasciapennis* is subincidental on pineapple, preying on minute insects. *Haplothrips fusca* and *H. flavipes* are incidental species and flower feeders. *Haplothrips melaleuca* is a predator found on a moderate range of plants and is subincidental on pineapple, especially on planting material, but quite incidental on other plants. *Haplothrips sakimurai* is a subincidental species and some evidences indicate that there may be other hosts besides *Emilia*. *Kentronothrips hawaiiensis* is known to feed on sugar cane only, on which it is common. *Phloeothrips claratibia* and *Stephanothrips occidentalis* are incidental species, the former being collected on pineapple.

DISCUSSION

Literature on thrips as the vector of virus diseases was recently reviewed by Bailey (2). Data on thrips vectors published up to the present are compiled in Table 2. *Thrips tabaci* is the most outstanding vector and two diseases were definitely proved to be transmitted by it; three other positive cases without suf-

[3] Identified by D. Moulton but not included in his papers.

ficient experimental evidence and six other negative cases are known. Three species of *Frankliniella* were proved to transmit a single disease at different localities. Five other species are known to transmit the diseases without sufficient experimental evidence, and three species showed negative for transmission of the diseases. As Bailey (2) has pointed out, little is known concerning thrips in relation to virus transmission and many other suspected vectors came into the consideration, because of the similarity of the insect's bionomics to those of the proved vectors, especially in food habits, life cycle, population density and host range. However, very few attempts have been made for a thorough search of more efficient or supplemental vectors of the disease. Concerning this point, the case of tomato spotted wilt is very interesting. The disease was found to be transmitted by four different vectors in different localities and two species are known to be vectors simultaneously at two respective localities. These three species (data of *Frankliniella* sp. in South Africa are lacking) have a wide host range and a predominant population in these respective localities. These data are quite suggestive of a probable existence of more efficient or supplemental vectors of the pineapple yellow spot in Hawaii in addition to *Thrips tabaci* which was definitely proved. This is further emphasized by the following: Some data on the relative incidence of *T. tabaci* and the disease seem somewhat difficult to explain on the strict assumption of the existence of a single vector known at present.

Twenty plants are known to be susceptible to the disease, beside *Emilia* and pineapple (8, 10, 11).[4] Table 3 presents these plants, and the relative population density of the 15 species of thrips assocaited with them. *Thrips tabaci* is the only species generally found throughout on these plants, and furthermore it breeds on them. This species was not collected from some of the plants but an experimental test (by Dr. Linford) suggests that the plants are within its host range. *Aleurodothrips fasciapennis, Haplothrips melaleuca, Aeolothrips fasciatus* and *Hercothrips femoralis* were collected from these plants but are excluded from the group because of their apparent predacious habits, or of their non-feeding on any susceptible plant, or their feeding restriction in greenhouses.

[4] In addition to these references Dr. Linford has kindly made available his unpublished data on this subject.

TABLE 2. LIST OF KNOWN T

Vectors	Diseases transmitted	Major hosts	Localities where dis are preva
Thrips tabaci Lind.	Mosaic	Spinach	Germany
	Spotted wilt	Tomato	Australia
		Tobacco	England
		Tomato	Calif. (U
		Tomato	Ont. Sask
		Pea	Wis. (U.
	Tobacco mosaic Greenhouse streak	Tomato	England
	Yellow spot	Pineapple	Hawaii
		Pineapple	Philippin
	Mosaic	Tomato	Ind. (U.S
	Leafroll	Potato	Ind. (U.S
	Yellow stripe	Narcissus	England
	Yellow dwarf	Potato	Wis. (U.
	A necrotic virus	Tobacco	England
	Yellows	Peach	U.S.A.
	Streak	Tobacco	Wis. (U.
Thrips flavus Schrank	Mosaic	Beans	Germany
Thrips minuta var. *puttemansi* Costa Lima	Mosaic	Sugar cane	Brazil
Thrips sp.	Mosaic	*Capsicum*	India
	Stolbur disease	Tomato	Russia
Frankliniella n.sp. Bagnall	Spotted wilt	Tomato	Australia
		Tomato	New Zea
Frankliniella moultoni Hood	Spotted wilt	Tomato	Calif. (U
Frankliniella sp.	Kromneck disease (Spotted wilt)	Tobacco	South Af
Hemianaphothrips sp.	Spotted wilt	Tomato	Australia
Hercothrips femoralis (Reuter)	Yellows	Peach	U.S.A.
A greenhouse thrips	Streak	Tobacco	Wis. (U.
"Thrips" (A mixture of *Thrips imaginis* Bag., and others)	Witches' broom	Lucerne	Australia
"Thrips"	Mosaic	Eucharis lilies	Bermuda
"Thrips"	Mosaic	Potato	Maine (U

[1] References not cited by Bailey (2) are listed in literature citation.
[2] There appears to be some doubt as to whether pineapple yellow spot actually exists
[3] *Thrips nigropilosus* Uzel, *Haplothrips* sp. and *Physothrips* sp. failed to feed on tom

KNOWN THRIPS VECTORS AND VIRUS DISEASES.

Localities where diseases are prevalent	Experimentally tested		Suspected of positive transmission	Authorities[1]
	Positive	Negative		
Germany	+?			Schaffnit (1927)
Australia	+?	—	Yes	Pittman (1927); Samuel, Bald, Pittman (1930); Samuel, Bald (1931)
England	++			Smith (1931)
Calif. (U.S.A.)	++			Gardner, Whipple (1934)
Ont. Sask. (Canada)	Insect vector was not tested			Berkeley (1935)
Wis. (U.S.A.)	++			Whipple (1936)
England		—		Jarret (1930)
Hawaii	++			Linford (1931)
Philippines	++			Serrano (1935)[2]
Ind. (U.S.A.)	+?		Yes	Cleveland (1931)
Ind. (U.S.A.)		—		Cleveland (1931)
England			Yes	Hodson (1932)
Wis. (U.S.A.)		—		Koch (1934)
England		(Prelim. test)—		Smith (1935)
U.S.A.		—		Hartzell (1935)
Wis. (U.S.A.)		—		Johnson (1936)
Germany	+?			Böning (1927)
Brazil	+?			Putteman (1926)
India	+?			Uppal (1929)
Russia			Yes	Koratshevsky (1935)
Australia	++			Samuel, Bald, Pittman (1930); Steele (1935)
New Zealand	Insect vector was not tested			Chamberlain, Taylor (1936)
Calif. (U.S.A.)	++			Gardner, Whipple (1934)
South Africa	++			Moore (1933)
Australia		—		Samuel, Bald, Pittman (1930)[3]
U.S.A.		—		Hartzell (1935)
Wis. (U.S.A.)		—		Johnson (1936)
Australia	+?		Yes	Edwards (1936)
Bermuda			Yes	Whetzel (1923)
Maine (U.S.A.)			Yes	Schultz, Folsom (1925)

tually exists in the Philippines.
feed on tomato when tested.

TABLE 3. SPECIES AND POPULATIONS

HOST PLANTS	Naturally infected	Experimentally infected by *T. tabaci*	*Taeniothrips alliorum*	*Taeniothrips hawaiiensis*
Bromeliaceae				
Ananas comosus	+	+		
Liliaceae				
Allium sp.	—	—	4*	
Cordyline terminalis	+	+		
Caryophyllaceae				
Drymaria cordata	+	+		
Leguminosae				
Pisum sativum	+	+		
Labiatae				
Stachys arvensis	+	+		
Solanaceae				
Capsicum frutescens	+?	+		
Lycopersicon esculentum		+		
Nicotiana glauca		+		
Nicotiana poncha	+	+		
Nicotiana tabacum		+		
Solanum melongena		+		
Solanum nodiflorum	+	+		1
Rubiaceae				
Richardsonia scabra	+	+		
Compositae				
Ageratum conyzoides	+	+		
Bidens pilosa		+		
Callistephus chinensis		+		C
Emilia sagittata and 2 other species	+	+	1	
Erigeron canadensis	+	+		
Galinsoga parviflora	+	+		
Taraxicum officinale		+		

1 = Incidenta
2 = Low po
3 = Modera
4 = High po
C = Citation
* The insec

ATIONS OF THRIPS ASSOCIATED WITH THE SUSCEPTIBLE PLANTS OF YELLOW SPOT VIRUS.

PHYTOPHAGOUS											PREDACIOUS OR UNCLASSIFIED				
Taeniothrips alliorum	Taeniothrips hawaiiensis	Taeniothrips frici	Thrips abdominalis	Thrips panicus	Thrips tabaci	Thrips tecterneci	Hoplothrips paumalui	Haplothrips gowdeyi	Haplothrips sakimurai	Phloeothrips claratibia	Aeolothrips fasciatus	Hercothrips femoralis	Aleurodothrips fasciapennis	Haplothrips melaleuca	REMARKS
				3*	3*	1				1		3*	2*	2*	
4*					4*			1*			2*				
															Negative
															No sample
					2*										
					1			3*							
															No sample
												3*			
					3*										No sample
															No sample
												3*			
	1				3*										
					3*			2*							
					3*			2*							
			3*		3*			3*							
	C		4*		3*										
1			3*	1	4*		1	4*	1			3*		1	
					3*			4*							
		2*													Negative

1=Incidental population.
2 = Low population.
3 = Moderate population.
4 = High population.
C= Citation from reference.
* The insect is definitely known to breed on these plants.

Taeniothrips frici, T. hawaiiensis, T. alliorum, Thrips abdominalis, Hoplothrips paumalui, Haplothrips gowdeyi and *Haplothrips sakimurai* were present on one or more of the susceptible plants but not on pineapple. The presence of *Thrips trehernei* and *Phloeothrips claratibia* on pineapple was very incidental and was not found on any other susceptible plant. *Thrips panicus* and *Thrips tabaci* are the only species collected from pineapple and other susceptible plants. *T. panicus* breeds on pineapple but its breeding on *Emilia* is doubtful. *T. tabaci* breeds on flowers or the succulent basal portion of young leaves of pineapple, and also very freely on *Emilia*. Furthermore, the evidence of frequent accompaniment of the initial spot (the earliest symptom of the disease) with its typical feeding scars or egg punctures on pineapple leaves confirms the definite relationship between this insect and disease on pineapple.

Taeniothrips frici, T. hawaiiensis, T. trehernei and *Phloeothrips claratibia* were present on one or more of the susceptible plants but not on *Emilia*. *Taeniothrips alliorum, Hoplothrips paumalui* and *Haplothrips sakimurai* were present on *Emilia* in small numbers but not on any other susceptible plants. *Thrips abdominalis, T. tabaci, T. panicus* and *Haplothrips gowdeyi* were collected from *Emilia* and also from other susceptible plants. All except *Thrips panicus* breed on *Emilia*. They, in addition to *Thrips tabaci*, are suspected strongly of acting as the vectors, at least between weed hosts, because *Emilia* is the major host of the virus and because the insects breed on *Emilia* and are polyphagous. The transmission of the disease by *T. tabaci* among weed hosts with a various host sequence was recently proved (8).

However, virus inoculation is possible with very short periods of feeding by the insect vector. Thus accidental feeding is sufficient for a successful inoculation, although the percentage of infection may be lower. Therefore, the susceptible plant can be infected whether or not it is a normal breeding plant of the vector. If the suspected vectors are similar to the proved vectors of yellow spot or spotted wilt, they can be infected only during their larval stage. Thrips larvae very seldom move away from the plant where they have hatched. Therefore, contiguity of the normal breeding plant and the susceptible plant is essential only for the vector to become infected and not for the plant to become infected. Con-

trary to the negligible migratory habits of the larval stage, the adults are usually and quite frequently dispersed by means of air currents. This is true for nearly all species, and evidence indicates that very large numbers of individuals and species are blown into pineapple fields. This will also be true in other ecological surroundings. Again if the suspected vectors are similar to the proved vectors, they can retain virulence for a long time in their adult life. Therefore, any thrips, which has a transmitting capacity of the virus and breeds on infected plants, can disperse to other plants of the same susceptible species and easily transmit the virus without subsequent recontamination from other sources of infection, and can also transmit to plants of other susceptible species if the insect is not a specific feeder. This is true for both the flower and leaf feeders. The influence of the host sequence of the virus upon the degree of virulence (attenuation or devirusing) (8) comes into consideration here.

The true host ranges of these thrips may be wider than those presented in the data. This is true especially because the adults are dispersed by air currents; in this way many species of thrips may be carried to a variety of plants and many plants may also act as sources of dispersal. Therefore, the suspected vector range must not be restricted to the listed species associated with the susceptible plants. In fact, there are many evidences which suggest the existence of other vectors of the yellow spot disease and a critical test of the transmitting capacity of these thrips should be undertaken.

SUMMARY

The record of host ranges of thrips in and around pineapple fields is presented and their possible relation to the vector of the yellow spot virus in Hawaii discussed.

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New Records of Mealybugs in Hawaii

BY AMY SUEHIRO
Bernice P. Bishop Museum

(Presented at the meeting of June 4, 1936.)

The mealybugs recorded in this paper include two species, *Pseudococcus maritimus* (Ehrhorn) and *Phenacoccus solani* Ferris, both of which species are described from California, where they occur on a wide variety of host plants, both wild and cultivated. A very rigid quarantine has kept these pests out of Hawaii for a good number of years, and it is to be hoped that the very few colonies of these which have been collected so far indicate an accidental infestation and not their establishment here.

Pseudococcus maritimus (Ehrhorn).

In life, covered with meal, not hiding segmentation. With 17 pairs of marginal filaments, lateral ones short, caudal pair longest, reaching 2 mm. in length. Color reddish; oviparous; secreting a white, fluffy mass enveloping eggs. On slide, may be distinguished from *brevipes* which it resembles more closely than other species in Hawaii, by presence of rimmed tubular ducts on the venter.

Originally described from *Eriogonum latifolium*, *maritimus* has been recorded on a great number of hosts, doing much damage to citrus fruit and grapevines in California. It has been recorded from the Dry Tortugas Islands near Key West, where it infests sweet potato, tomato and avocado and has also been found in greenhouses in England. *Maritimus* is one of the commonest species of insects to be intercepted at quarantine in Hawaii, but was not known to be established here until the discovery by Mr. O. H. Swezey of a colony of mealybugs on stored gladiolus bulbs (grown in his garden) which turned out to be this species. This indentification has been verified by Mr. G. F. Ferris of Stanford who kindly compared it with slides of *maritimus* in his possession. The discovery and possible establishment of this troublesome mealybug in Hawaii is greatly to be regretted.

Phenacoccus solani Ferris.

In life, sparingly covered with white meal; segmentation distinct. With two pairs of very short caudal filaments, lateral filaments apparently absent. On slide, with 8-segmented antennae; small but distinct tooth on claw. Spines small; sharply filiform at apex resembling those of *Pseudococcus kraunhiae*. Dorsal body setae characteristically lanceolate.

Phenacoccus solani was originally described from Santa Cruz Peninsula on roots of *Hemizonia rudis*. It is also found on roots or crowns of potato, tomato, Ambrosia, wild radish, portulaca, etc. It was found in Kaimuki, Oahu, on roots of *Portulaca oleracea*, and is the first record of the genus *Phenacoccus* in the Hawaiian Islands.

A New Species of Dictyophorodelphax From the Island of Lanai (Homoptera)

BY O. H. SWEZEY
Experiment Station, H.S.P.A.

(Presented at the meeting of January 2, 1936)

Dictyophorodelphax usingeri n. sp.

Female: length, 5 mm.; head prolongation, 2 mm.; tegmen, 1.25 mm. Fuscous with slight whitish flecking; legs testaceous with dark fuscous spots; clypeus dark fuscous, ventral side of head prolongation pale fuscous in front of this; tegmina testaceous with dark fuscous on margin between apical veins and a black mark at apex of clavus; setigerous black dots on the veins. Tegmina short, hardly covering half of the abdomen. Head prolongation shorter than the rest of the body, apical third compressed and slightly curved ventrally, space between dorsal carinae gradually coming to a point at apex, lateral carinae confluent at about three-fourths from base, dorsoventral width about 1 mm., nearly uniform width throughout.

This species is nearest to *praedicta* which occurs in Iao Valley, Maui. The latter species, however, lacks the setigerous black dots on the tegmina. The apical ventrally-curved portion of the head prolongation is shorter and wider dorsoventrally in *usingeri* than in *praedicta*, the lateral carinae are confluent at a point farther from the base than in *praedicta*.

No males are at hand for making comparison of the genital styles and aedeagus.

Lanai, trail to Lanaihale, 2,000-3,000 ft., Nov. 29, 1935, 3 females collected on Euphorbia by Mr. R. L. Usinger.

Holotype and paratypes in the Bishop Museum collection.

This makes the fourth species of the genus now known in the Hawaiian Islands. Two of them on Oahu: *mirabilis* at various localities in the Koolau range from Konahuanui to Hauula and on Kaala; *swezeyi* at Wailupe and Niu. One on Maui: *praedicta* in Iao Valley. One on Lanai: *usingeri* at Lanaihale. All of them occur on some species of *Euphorbia*.

Table for distinguishing the species of Dictyophorodelphax.

1. Apical portion of head prolongation bent ventrally,.....2
   Head prolongation gradually inclined upwards all the way to the apex; lateral carinae confluent at about middle; tegmina with setigerous black dots on veins,.....swezeyi

2. Head prolongation longer than the body, not compressed apically, lateral carinae confluent a little beyond middle; tegmina with setigerous black dots on veins,.....**mirabilis**
Head prolongation compressed for about apical third,.....3

3. Head prolongation about same length as body, lateral carinae confluent at about two-thirds from base; tegmina without setigerous black dots on veins,.....**praedicta**
Head prolongation shorter than the body, lateral carinae confluent at about three-fourths from base; tegmina with setigerous black dots on veins,.....**usingeri**

Notes on the Food of the California Quail in Hawaii

BY O. H. SWEZEY
Experiment Station, H.S.P.A.

(Presented at the meeting of April 2, 1936.)

An opportunity was had of examining the crops of nine quails killed at Kanoa, Molokai, November 13, and December 15, 1928. The crops were packed full and contained the following materials, being chiefly seeds, instead of insects, as might have been expected:

	Seeds of *Acacia farneziana*	Seeds of *Prosopis chilensis*	Grass seeds *Chaetochloa verticillata* (?)	Weed seeds *Chenopodiaceae* (?)	Amaranth seed	Other seeds	Beetle larva *Dirempius epitragus*
Crop No. 1:	51	6			1	6	
Crop No. 2:	39	5	366				1
Crop No. 3:	58	9		62			
Crop No. 4:	28	3					
Crop No. 5:	27	9					
Crop No. 6:	32	10					
Crop No. 7:	21		143	45			
Crop No. 8:	38		7	54			
Crop No. 9:	15		155	176		1 *Bruchus sallaei*, 1 pupa	

Besides the seeds, the crops contained a considerable amount of fragments of pods, probably chiefly of the *Acacia,* but no doubt also some of the *Prosopis.*

Notes on Potato Insects in Hawaii

BY O. H. SWEZEY
Experiment Station, H.S.P.A.
(Presented at the meeting of April 2, 1936)

The past few months have brought to a successful venture the raising of potatoes on a large scale on fallow cane lands at Oahu Sugar Co. and at Waialua Agricultural Co. on the island of Oahu. The former had some 130 acres in potatoes and the latter some 80 acres. Their plantings were timed so that the crop ripened over a period of two or three months, so as not to overstock the California markets, where they were shipped and sold as "new potatoes" at an advantageous season of the year—February and March. During the growth of these potato crops, some insects were found attacking the leaves and tubers not hitherto recorded on this plant in Hawaii. It is the purpose of these notes to place these on record.

Laphygma exigua (Hub.).

This pest was breeding on weeds growing on waste land and along roadways in the vicinity of a large potato field. Their preferred host plant was amaranth, and they were feeding on this weed where it was growing in the potato field also. The caterpillars also fed on the potato plants to some extent. Control was brought about by Paris green included in the Bordeau spray mixture which was being used to prevent blight.

Agrotis ypsilon Rott.

The greasy cutworm was present to some extent, feeding on weeds, also on the potato plants, and when the potatoes were being harvested, frequently tubers were found considerably eaten by them. As a demonstration of their eating capacity, a full-grown cutworm when placed with an uninjured tuber over night ate a cavity as large as its own bulk.

Lycophotia margaritosa (Haw.).

A few of the variegated cutworm were also found working similarly to the above.

Plusia chalcites Esp.

The green looping caterpillars of this moth were common, producing ragged appearance of the leaves, but not numerous enough for distinct injury.

Phthorimaea operculella (Zell.).

The potato tuber moth is perhaps the worst insect pest on potatoes in Hawaii, but none was observed at this time. The crop was to be harvested expeditiously and no doubt would escape being injured by this pest. It has caused considerable injury at times when the tubers were allowed to remain in the ground unduly, or stored where accessible to the moth.

Pantomorus godmani (Crotch).

One larva of the Fuller's rose bettle was found boring into a tuber. No doubt if numerous in a field considerable injury might be done by them.

Conoderus exsul (Sharp).

A larva of this elaterid beetle was found in a decaying tuber, but it was evidently not the cause of the rot. If numerous in a field this wireworm might cause some injury to tubers, though it is primarily predacious in habit.

Empoasca solana DeLong.

An occasional leafhopper was found, not numerous enough for an infestation.

Stictocephala festina (Say).

Two nymphs of this membracid were found on potato foliage, one of them reared to maturity. It is rather a general feeder, this apparently being the first record of it on potato in Hawaii.

Aphis gossypii Glover.

In one large field there was a general infestation by the cotton aphis, causing the drying up of the foliage somewhat prematurely.

Myzus persicae (Sulzer).

The peach aphis was present to some extent in the same infested field.

These are the first records of infestations by these aphids on potato in Hawaii. A number of the enemies of aphids were present but not numerous enough to control them. Those observed were the following:

Ladybeetles: *Coelophora inaequalis* (Fab.).
Pullus kinbergi (Boh.).

Syrphid flies: *Ischiodon scutellaris* (Fab.).
Allograpta obliqua (Say).

Predacious bug: *Reduviolus capsiformis* (Germ.).

Braconid parasite: *Lysiphlebus testaceipes* Cress.

Hyperparasite: *Aphidencyrtus aphidivorus* (Mayr).

A New Species of Koanoa From the Hawaiian Islands (Miridae, Hemiptera)

BY R. L. USINGER
University of California

(Presented at the meeting of March 5, 1936)

Koanoa williamsi n. sp.

Whole surface polished, clothed with a rather even, moderately dense, pallid pubescence; a long bristle projecting on either side from antero-lateral angles of pronotum and four long bristles on basal antennal segment, two on inner side, one dorsal and one ventral. Dorsum obscurely, rugosely punctate.

Male. Head transverse, 11.5::14.5, the vertex one half width of head including eyes. Antennae quite stout, first two segments thicker than front tibiae; the first segment narrowed in basal third, second thick and cylindrical except narrowly at apex where it is evenly roundly narrowed, and at base where it gradually becomes more slender in basal sixth; apical two segments very slender and delicate; proportion of segments one to four as 6.5:18:9.5:7. Rostrum typical of genus, short, reaching only to hind margin of mesosternum, the proportion and shape of segments as in *hawaiiensis* Kirk. Pronotum strongly transverse, 23.5::14, but less so than in *hawaiiensis*, 27::15; posterior margin lightly emarginate at middle, otherwise evenly rounded to humeral angles; surface lightly, transversely rugose except on callosities which are simply ill-defined elevations with a faintly granular surface. Scutellum but little wider at base than long, strongly depressed at sub-basal suture, then lightly elevated and transversely rugose to apex.

Color shining black, the apical two antennal segments and basal sixth of second segment, rostrum except at tip, anterior and intermediate legs except for obscure, sub-apical fuscous rings on femora, posterior coxae more or less, trochanters, bases and apices of femora narrowly, and apical third of tibiae and tarsi testaceous. Eyes reddish brown. Membrane dark fumose throughout.

Length 2.68 mm., width (hemelytra) 1.2 mm.

Female. Differs from the male in being relatively broader behind, at level of commissure of clavus. Pronotum relatively narrower and also less strongly rounded than in the female of *hawaiiensis*. Antennal proportions 7:16.5:10:8, the basal segment as in the male, second segment slender at base, gradually thickened toward apex but even at thickest point decidedly less incrassate than in male. Eyes scarcely smaller than in male, the vertex slightly more than half total head width, 8::15.

Color much as in the male but with only apical third of second antennal segment black.

Length 2.8 mm., width (hemelytra) 1.32 mm.

Holotype male, allotype female, and four paratypes collected at the summit of Lanihuli, Oahu, 2,775 ft., II-23-'36, on *Freycinetia* (F. X. Williams and R. L. Usinger). Two paratypes, Mt. Olympus, Oahu, III-31-'35, *Freycinetia* (O. H. Swezey). In addition, two specimens are at hand, one damaged and one tenerel, as follows: S. E. Koolau Mts., Cooke trail, Oahu, June, 1917 (J. C. Bridwell) and Wailupe, Oahu, I-11-'25 (O. H. Swezey).

This species is superficially quite like *hawaiiensis* Kirkaldy but may be distinguished at once by its shorter, broader form with narrower, less rounded pronotum, by the much shorter and regular pilosity of the dorsum, by the normal sized eyes in the male, and by the differently colored antennae.

Apparently restricted to the Ieie vine, *Freycinetia arborea* Gaud., where it occurs, not uncommonly, between and at the bases of the clasping leaves particularly toward the top of the leaf cluster where the youngest and tenderest foliage is to be found.

Nymphs of four stages were taken as follows:

First instar. Very small, pink in coloration, long and subparallel in form. Rather hairy above and with darker bristles along lateral margins. Tylus quite strongly elevated. Eye facets few in number and very large. Rostrum reaching middle coxae, the first segment robust. Antennal proportions 2.5:4.5:4:6.

Length .88 mm., width (metanotum) .30 mm., width of head .26 mm.

Second (or third) instar. Body above covered with moderately long pallid hairs and a few longer, darker bristles along thoracic and head margins. Antennal segments one to four in proportion of 3.5:6:5:6. Reddish in color with brown eyes and testaceous antennae, legs, and rostrum.

Length 1.28 mm., width (abdomen) .48 mm., width of head .32 mm.

Fourth instar. Considerably larger, darker, and of more rounded form. Wing pads covering first abdominal segment laterally. Rostrum reaching middle coxae. Antennal proportions 4.5:10:6:8. Head and thorax brown.

Length 1.76 mm., width (abdomen) .82 mm., width of head .44 mm.

Fifth instar. Head and thorax dark brown, polished, covered with a fairly dense, pallid pubescence. Wing pads reaching almost to fourth abdominal segment. Pronotum, head, and basal antennal segments with the same long bristles noted in the adult. Genital segment in this, as in previous instars, produced posteriorly in the form of a tube, longer than wide. Rostrum attaining intermediate coxae. Antennal proportions 6:14:9:8, the first and second segments thickest. Tarsi with a very short basal segment

and a long apical one. Abdomen dorsally pink with broad testaceous areas posteriorly and medianly on each segment. A large circular red spot is seen at middle of second abdominal segment. Antennae, rostrum, and legs as well as center of venter light ochraceous.

Length 2.4 mm., width (wing pads) 1.04 mm., width of head .56 mm.

Two New Pacific Island Species of Nysius (Lygaeidae, Hemiptera)

BY ROBERT L. USINGER
University of California

(Presented by Dr. Williams at the meeting of December 3, 1936)

The occurrence of endemic insects on the low coral islands of the Pacific has yet to be adequately explained. Such a phenomenon argues either for an extremely plastic group or organisms with a ready means of dispersal or for a much longer history and previous period of emergence than has generally been accepted for these islands. The material upon which the present paper is based was collected personally by Mr. E. H. Bryan Jr. on trips of the Tanager and Itasca or was brought together by collectors encouraged by him. Types have been deposited in the collection of the B. P. Bishop Museum.

Nysius picipes n. sp.

Male. Head four-fifths as long as broad across the eyes, its surface finely, rugosely punctate and densely, irregularly clothed with short white hairs. Antennae almost as thick as basal portion of front tibiae, the first segment thickest, quite robust, second and third linear, slightly thickened at apices, fourth thicker and more densely pilose than the preceeding segments; proportion of segments one to four as 8:18:15:16. Rostrum attaining posterior coxae, first segment reaching base of head, surpassing bucculae which are moderately elevated at base of rostrum and gradually decrease in height posteriorly until they disappear at a level about two thirds the distance from insertion of antennae to base of head. Pronotum as long as wide anteriorly, distinctly broader posteriorly, 29::18, its sides strongly sinuate, arcuate at level of callosities and feebly elevated at laevigate humeral angles; disk, except for finely granular callosities, pleura and sterna coarsely punctate, clothed with a white decumbent pubescence anteriorly. Scutellum broader at base than long, 19::13, strongly elevated at center, the longitudinal carina obscure; surface very coarsely punctate and clothed with decumbent white

hairs; lateral margins feebly carinate on posterior half, the apex distinctly elevated. Hind margin of metapleuron feebly emarginate, lightly reflexed, the lateral angle scarcely produced, rounded. Corium sparsely, rather evenly hairy, lateral margins parallel to level of two-thirds of scutellum, then lightly but distinctly dilated beyond middle and narrowed apically.

Length 3.84 mm., width (dilation of corium) 1.24 mm.

Female. Similar to the male but much more robust with the lateral margins of the pronotum slightly less sinuate.

Length 4.4 mm., width (dilation of corium) 1.48 mm.

Color black, the antenniferous tubercles above, tylus medially, inner margins of eyes, longitudinal line on vertex, bucculae, anterior portion of pronotum before callosities, prosternum, elevated anterior margin of osteolar canal, plates surrounding coxae, pronotum laterally behind callosities and before fuscous posterior region, tip of scutellum, clavus except apically, corium except at inner apical angle and more or less between first and second longitudinal veins which are fuscous to black, and expanded costal region which is hyaline, light testaceous to ochraceous. Membrane hyaline with brown spots at center of apical margin of corium and opposite inner corial vein intruding slightly onto testaceous corial margin, and indistinct spots at middle. Antennae brown, the first segment darker, fusco-piceous in apical two thirds, second and third segments darker at base and apex. Rostrum testaceous to fulvous, the first two segments lighter, the apical ones darker. Coxae black except at apex, femora pitchy brown to black, lighter testaceous and often spotted broadly at base and on the trochanters as well as narrowly at apex. Tibiae and tarsi testaceous with more or less fuscous at bases and apices of segments. In the females testaceous markings extend from base of head to either side of the tylus and the venter, except along ovipositor and more or less at sides, is lighter, testaceous.

Holotype male, August 1, 1923, allotype female, July 31, 1923, and numerous paratypes from July 27 to August 5, 1923, Wake Island, E. H. Bryan, Jr., collector, on *Sessuvium, Cordia, Portulaca, Boerhaavia,* and *Sida.* Twenty-nine specimens, including the allotype, were taken on Peale Island and one adult and two nymphs were captured on Wilkes Island, both of the Wake group.

Closely allied to *vinitor* Bergroth from Australia and forming, with that species and *pulchellus* Stål from Guam, a unit within the typical subgenus *Nysius.* From *vinitor* it may be distinguished by the pitchy black femora, coarsely punctate head, pronotum, and scutellum, and the dilated corial margin. From *pulchellus* it may be distinguished by the black femora, dilation of the corium, and shorter and less dense pubescence. These species all have a simi-

larly shaped pronotum and a similar color pattern which results in a superficial resemblance.

Nysius oceanicus n. sp.

Male. Head very large, almost as wide, eyes included, as pronotum behind, 21::23; transverse, 21::17; rugosely punctate and covered with a dense, short, white pubescence. Antennae rather robust, the first and fourth segments thickest; proportion of segments one to four as 7:13:11:12. Rostrum attaining hind coxae, the first segment not reaching base of head, scarcely surpassing bucculae which gradually disappear at a level two thirds the distance from insertion of antennae to base of head. Pronotum transverse, the lateral margins broadly rounded at anterior angles, then subparallel at middle and abruptly flaring out posteriorly to humeral angles which are lightly elevated; as broad at joining of head and pronotum as long, broader at middle, 20::15, and still broader posteriorly, 23::15; anterior lobe rounded at sides, almost cylindrical; disk coarsely punctate except for finely rugosely granular callosities and laevigate humeri; clothed at anterior margin with long golden or white hairs which extend onto base of head; elsewhere except for a narrow sinuate smooth line on callosities, covered with a short white pubescence less dense at the base; posterior margin lightly quadrisinuate. Scutellum transverse, 13::9, with an indistinct triradiate callous at center, the apex feebly elevated, subrounded; thickly beset with short white hairs. Posterior margin of metapleuron scarcely emarginate, strongly reflexed, the lateral angle rounded, not produced. Corium more sparsely covered with short white hairs than pronotum and scutellum. Lateral margin of corium barely sinuate just before base with a light flare at level of apical fourth of scutellum; rather abruptly narrowed behind.

Length 3.28 mm., width (dilation of corium) 1.04 mm.

Female. Much larger than the male and but little narrowed behind.

Length 4.08 mm., width (dilation of corium) 1.28 mm.

Color testaceous, the basal two thirds of first antennal segment, head except bucculae, a small spot beneath each eye, tylus at middle, a line from vertex extending interruptedly forward on either side of tylus and at inner margins of eyes, pronotal callosities, pro-, meso-, and metapleura and sterna, scutellum at middle, venter laterally and at base, and apical two segments of rostrum black. More or less on apical three segments of antennae, inner cells and veins of corium and clavus irregularly on apical half, particularly apical elevated margin of two inner cells, basal segments of rostrum, spots on femora which may coalesce, and apical tarsal segments fulvous. Eyes brown. Membrane with several obscure brown blotches.

Holotype male, allotype female, and twenty-seven paratypes, Jarvis Island, July 7, 1935, W. W. Graf collector, ex *Boerhaavia*; and four paratypes, Jarvis Island, March 25, 1935, ex *Tribulus*,

six paratypes, Jarvis Island (S. W. Side), March 26, 1935, ex *Tribulus* and *Boerhaavia,* E. H. Bryan Jr. collector.

A great deal of color variation is exhibited in the series of paratypes, the antennae and legs often being entirely fulvous while the femora may become almost black.

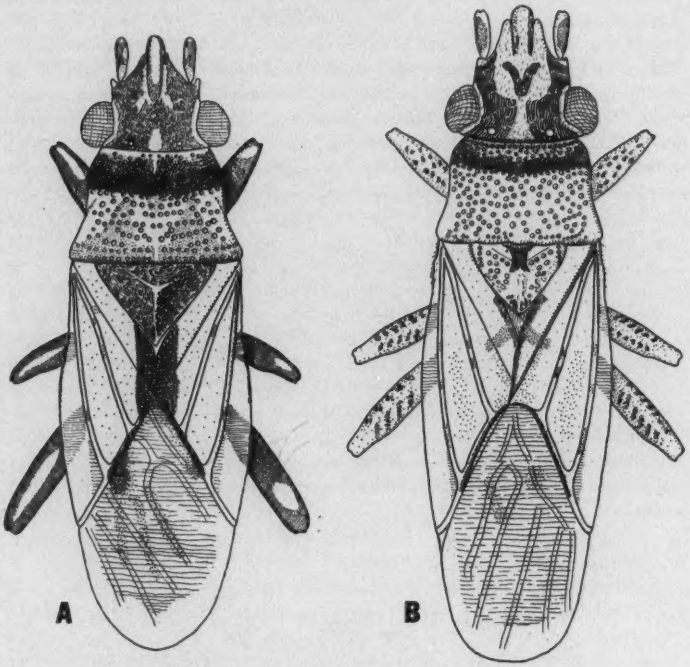

Figure 1. A. *Nysius picipes* n. sp. The male holotype is figured. B. *Nysius oceanicus* n. sp. The female allotype is figured.

This species is quite distinct from any described species known to me. It is perhaps closest to the Hawaiian species, *dallasi* White and *longicollis* Blackburn. It may be distinguished from both of these by the broad head and sinuate pronotal margins and from *longicollis,* in addition, by the coarser pronotal punctures.

A New Name for Nysius monticola Kirkaldy (Lygaeidae, Hemiptera)

BY ROBERT L. USINGER
University of California

(Presented by Dr. Williams at the meeting of December 3, 1936)

Nysius kirkaldyi Usinger, new name.

As Mr. Kirkaldy was usually so critical of nomenclatorial lapses in others it is surprising to find *Nysius monticola* Kirkaldy, Fauna Hawaiiensis Supplement, Vol. II, pt. 6, pp. 544-545, Dec. 17, 1910, preoccupied by *Nysius monticola* Distant, Biologia Centrali-Americana, Hem.-Heter., I, Suppl., p. 383, Tab. 34, figure 8, 1893. However, the supplement to the Hemipterous portion of the Fauna Hawaiiensis was in press during Mr. Kirkaldy's serious illness and was published after his death so he had no opportunity to check on the matter. Under the circumstances it seems particularly appropriate to dedicate this species to Mr. Kirkaldy who did so much of the early work on the Hawaiian members of this difficult group.

The type locality for this species was given as "West Maui Mts., 4000 ft." with a footnote that No. 357 (on the under side of the card to which the specimen was affixed) referred to Haleakala, 4000 ft. As the three additional specimens which have since come to hand are all from Haleakala it would appear likely that the second locality is the true one.

A New Genus and Species of Baridinae From Amboïna (Coleoptera, Curculionidae)

BY ELWOOD C. ZIMMERMAN
Bernice P. Bishop Museum

(Presented at the meeting of September 3, 1936)

The following new genus is of especial interest to students of zoogeography because of its obvious and close relationship to the genus *Eremonyx* Marshall, now known only from Samoa and the Austral Islands. *Pseudoeremonyx,* like *Eremonyx,* is peculiar in that it is one of the few genera of the Baridinae that has only a single claw on the tarsi. Although over 3,000 miles separate the genera, further collecting will close this gap and show continuity in geographical distribution.

The types are stored in Bernice P. Bishop Museum.

Pseudoeremonyx new genus.

Head separated from the rostrum by a conspicuous, transverse impression; the frons as broad as the base of the rostrum. *Rostrum* stout, comparatively short, distinctly compressed in the basal half, narrowed dorsoventrally from the antennae apically; the antennae inserted at about the middle; mandibles strongly decussate and bidentate. *Antennae* with funicular segment seven distinct from the club; the basal segment of the club shining and sparsely setose. *Legs* with the trochanters each bearing an outstanding, erect seta and two inconspicuous, prostrate setae; the femora dentate, not grooved for the reception of the tibiae; tarsi with the claw segment short, slender, and bearing a single claw. *Sternum* with the prosternum transversally impressed and without a prosternal furrow; the fore coxae separated by a distance equal to only about half the width of a coxa; the metasternum between the mesocoxae slightly narrower than a mesocoxa. *Pygidium* vertical, strongly transverse, hardly impressed.

Genotype, *Pseudoeremonyx lucens,* new species

This genus is closely allied to *Eremonyx* Marshall (Insects of Samoa, part 4, fasc. 5, p. 308, 1931). It differs from that genus principally as follows: there is no prosternal furrow, the coxae are

more approximate, the hind femora are not distinctly grooved for the reception of the tibiae, and all the femora are dentate.

Pseudoeremonyx lucens new species (Fig. 1).

Derm shiny black with the appendages and sometimes the ventrites diluted with red, entirely devoid of scales.

Head finely reticulate, separated from the rostrum by a rather deep, broad, conspicuous impression that does not contain a median fovea. *Rostrum* with the dorsal outline strongly curved near the base, and thence slightly curved to the apex; almost straight from near the base to the apex below, somewhat shorter than the length of the pronotum, gradually expanded from the middle to the apex in lateral outline; reticulate, and with fine, scattered punctures above and rather coarsely, subconfluently punctate on the sides; with minute, inconspicuous setae above, with rather long prostrate setae on the sides, and with fine anteriorly curved setae below. *Antennae* rather

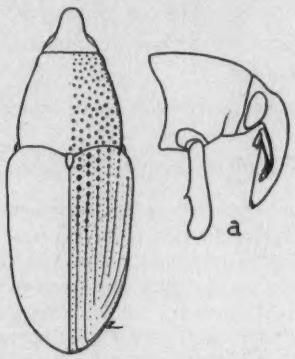

Fig. 1. *Pseudoeremonyx lucens*, new genus and species: a, lateral view of head and prothorax.

coarsely reticulate, with the scape as long as the first four funicular segments; first funicular segment about as long as 2-4 inclusive, 2-7, successively more transverse; club as long as the four preceding segments. *Prothorax* subconical, as broad as long, slightly arcuate on the sides, just perceptibly constricted before the apex above and there subtubular, the dorsal outline evenly convex longitudinally, highest at the middle; reticulate, the punctures rather small, separated by a distance equal to, or greater than, their diameters. *Scutellum* elongate-oval, slightly convex. *Elytra* reticulate, twice as long as the prothorax, about three-fourths as broad as long, broadest at the humeri, nearly parallel-sided to beyond the middle and thence broadly rounded to the apices; the dorsal outline even, without any impressions, with no posterior cali; striae fine, hardly impressed between the punctures near the base, the punctures much broader than the striae in the basal half, those near the

base larger than the pronotal punctures but gradually diminishing in size apically and not or hardly discernable on the apical third; intervals flat, each with a row of minute punctures. *Legs* reticulate, shallowly punctate; the femora often with several small denticles between the base and the sharp median tooth. *Sternum* with a deep, conspicuous fovea on each side of the middle at the lateral extremities of the transverse impression of the prosternum; metasternum with large, shallow, round punctures. *Venter* with the first two ventrites impressed down the middle in the male, all convex in the female; ventrite one as long as 2-4 inclusive, with numerous small punctures that are separated by a distance about equal to their diameters; the suture between one and two partially obliterated in the middle; ventrite two with small, scattered punctures, as long as 3 plus 4 which have a single row of punctures; ventrite five convex, closely punctate, as long as 3 plus 4. Length, 2.2-2.4 mm.; breadth, 1-1.1 mm.

Amboina, Molucca Islands. Holotype male, allotype female, and one male paratype, collected by F. Muir, January, 1908 (from the collection of the Hawaiian Sugar Planters' Association).

A New Chaetectetorus From Fiji (Coleoptera, Curculionidae)

BY ELWOOD C. ZIMMERMAN
Bernice P. Bishop Museum

(Presented at the meeting of October 1, 1936)

Heretofore the cryptorhynchine genus *Chaetectetorus* Schoenherr, has not been recorded from Fiji. One species has been described from Samoa, and the other known species are found principally in the Australian-Papuan region.

Chaetectetorus vitiensis new species (Fig. 1).

Derm reddish brown to piceous, scaling on the prothorax mostly pale yellow but with a conspicuous black patch on either side of the middle at the base, a smaller patch on either side of the median line at the middle, and another on the sides before the apex in the subapical constriction, scaling along the median line from the base to the subapical constriction pale brown in clean specimens; the scaling forming irregular, alternating dark and pale bands across the elytra; legs with a dark dorsal band on the middle of the femora, most pronounced on the posterior pair, the scales at the end of the femora often darker.

Head with the derm concealed by the spongy scaling, with a distinct interocular fovea and a single row of heavy, clavate setae along the inner

margins of the eyes that extends upon the rostrum to the antennae. *Rostrum* with two dorsal striae behind the antennae; densely squamose to the antennae in the female and beyond in the male; shining, but with numerous punctures and a few erect setae beyond the antennae. *Antennae* with the scape thick and heavy, only about as long as the first three funicular segments; funicular segment one heavy, as long as 2-4 together, two longer than broad, 3-7 successively more transverse; club oval, about as long as the preceding five segments together. *Prothorax* as broad as long, gradually, straightly expanding from the base to the abrupt and strongly defined subapical constriction; the base rather strongly bisinuate; dorsum uneven, with an elongate-oval median fovea near the base and two smaller foveae anterior to this on each side of the middle; the scaling extremely dense, spongy; with scattered, erect, black and pale spatulate setae that are most numerous near the apex. *Scutellum* with yellow scales. *Elytra* three-fifths as broad as long; humeri strongly developed; subparallel-sided to about the middle and thence rounded to the apex; base strongly sinuate, with a rather feeble, arcuate carina from the suture to the third interval; the subapical constriction strongly marked; the striae coarse, as broad as the intervals, the

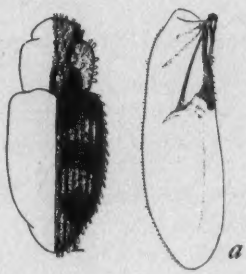

Figure 1.—*Chaetectetorus vitiensis*, new species; a. diagram of a wing.

punctures elongate, each bearing a seta at its base; intervals 3, 5, and 7 somewhat more elevated, the scales at their bases fasciculate in fresh specimens, the alternate intervals each with a row of conspicuous, erect, spatulate setae. *Sternum* clothed with a very dense amorphous scaling; the metasternum with some elongate setae. *Venter* clothed as the sternum; the first ventrite with a row of foveaform punctures bearing oval setae behind the basal margin; the setae on ventrites 2-4 are oval, on five they are more numerous, long and slender. Length, 2.8-3 mm.; breadth, 1.2-1.4 mm.

Fiji. Holotype, a female deposited in Bernice P. Bishop Museum, from Rewa, collected by Mr. Muir, April, 1906, from the collection of the Hawaiian Sugar Planters' Association, three female paratypes and one broken male specimen collected by E. H.

Bryan, Jr., July 12, 1924, on Moala Island; three of these specimens were found in rotten bark.

This is a small species closely related to *C. tutuilae* Marshall, from Samoa. From that species it can be distinguished by its somewhat larger size, by its darker, more distinct color pattern, by its larger, more numerous and conspicuous setae on the venter, rostrum, inner margins of the eyes, on the thorax and on the elytra.

I have included a drawing of a wing for the future use of students. The wings are densely and evenly set with short microtrichia which I have not shown on the drawing.

The Genus Osseteris in Fiji (Coleoptera, Curculionidae)

BY ELWOOD C. ZIMMERMAN
Bernice P. Bishop Museum

(Presented at the meeting of November 5, 1936)

The Papuan cryptorhynchine genus *Osseteris* Pascoe, 1872, has heretofore not been recorded from so far east as Fiji. Until now the genus has remained monotypic; the genotype, *O. scutellaris* Pascoe, from Dorey has been the only known species. This paper not only contributes to our knowledge of the geographical distribution of the genus, but it adds a genus and two new species to the coleopterous fauna of Fiji.

In Fiji this genus might be confused with *Heteromolius* Fairmaire, 1881. It differs from *Heteromolius,* however, by not having the mesosternal receptacle deeply cavernous, but with the mesosternum truncate and vertical in front, none of the elytral intervals cariniform, the rostrum longer, more slender, with considerable sexual dimorphism and by having the femora dentate. I believe that *Pseudomolius crassicornis* Fairmaire, 1881, most certainly belongs to *Osseteris,* but I have not seen a specimen of that species and, therefore, cannot reduce the genus to synonomy at present. It may even be one of those described below, but *P. crassicornis* was found on Ovalau and it is improbable that I have redescribed that species.

The types are stored in Bernice P. Bishop Museum.

KEY TO THE SPECIES

Pronotal punctures separated and not confluent in the middle of the disk and with a distinct median impunctate area; rostrum of the male not carinate; elytra of the male conspicuously bristling with long, erect, thin, sharp setae.....**marshalli**

Pronotal punctures coarsely confluent throughout, the disk without a median impunctate area; rostrum of the male distinctly carinate; elytra of the male without long, erect, thin, sharp setae, but with short, stout, spatulate setae .....**moalae**

Osseteris marshalli new species.

Derm reddish-brown to piceous, rather closely clothed above with prostrate or erect scales and squamiform setae; the elytra irregularly mottled with pale yellow and dark brown patches; scaling below whitish or pale yellow throughout.

Head with the crown reticulate, finely and sparsely punctate, the front closely but not confluently punctate, the punctures normally bearing small yellow setae; interocular area with a median fovea that continues anteriorly to form a narrow sulcus between the eyes; with numerous, broad, spatulate, slanting, squamiform setae on either side of the median line. *Rostrum* in the female almost straight, subcylindrical, with coarse punctation on the sides at the base only, elsewhere very finely and sparsely punctate; in the male shorter and heavier, flattened and subquadrate, densely setose to the antennae above, and thence shiny to the apex, coarsely and closely punctate throughout, not carinate. *Antennae* inserted at the middle of the rostrum in the female and somewhat more than a third from the apex in the male; scape as long as the first six funicular segments; funicular segments one and two elongate, two distinctly longer than one, as long as 3-5 inclusive, segments 3-7 successively shorter and more transverse; club as long as the three preceding segments together. *Prothorax* slightly broader than long (3.5:3), very slightly rounded, almost straight, on the sides from the base to the middle, and thence more abruptly rounded to the apex; the subapical constriction distinct but rather feeble; the longitudinal dorsal outline convex and but shallowly interrupted by the subapical constriction; base slightly sinuate, apex broadly and shallowly emarginate; punctation rather coarse but variable, the disk with an impunctate median line, the disk elsewhere with round, deep, close punctures, those in the middle of the disk usually well separated by the interstices; normally rather closely set with broad, elongate-oval, yellowish scales interspersed with fine, sharp, erect setae. *Scutellum* pubescent, rounded. *Elytra* three fourths as broad as long, twice as long as the prothorax, base sinuate, and there hardly broader than the prothorax, subparallel-sided from the base to the apical third and thence roundly narrowed to the apex, the longitudinal dorsal outline gently convex to the declivity which is steep and rounded; the striae deep and well marked, the punctures medium sized, deep and rounded, stria ten coarsely punctate

to the hind coxa only; intervals about twice as broad as the striae, roughened, closely set with conspicuously erect spatulate scales or squamiform setae, interspersed with conspicuously longer, bristling, thin, sharp setae in the male, those in the female shorter, stouter and not thin and sharp. *Legs* with the femora with closely appressed scales, with some erect ones below, armed at the apical third with a small denticle; tibiae more coarsely punctate, closely set with erect scales and setae, externally carinate, with a tooth at both the inner and outer apical angles in addition to the rather long, curved, median, apical uncus; the fourth tarsal segment very slender and longer than the two preceding segments together. *Sternum* with the mesosternal receptacle a plate between the mesocoxae, truncate and vertical in front, the rostrum not received in a cavernous cavity; metasternum rather coarsely and closely punctate, with scattered scales and setae, medianly impressed behind, the posterior margin broadly emarginate. *Venter* with the intercoxal piece obtusely pointed, all the ventrites set with round punctures bearing scales or setae; the first ventrite slightly longer than the next two together, two slightly longer than three plus four, about as long as five. Length, 5-7 mm.; breadth, 2.5-3 mm.

Ongea, Lau, Fiji. Holotype male, allotype female, two male and seven female paratypes collected by Mr. E. H. Bryan, Jr., July 31, 1924.

It is with pleasure that I dedicate this species to Sir Guy A. K. Marshall as a slight token of appreciation for his unfailing kindness in aiding me in my studies.

Osseteris moalae new species.

Closely allied to *O. marshalli*, but differing from that species principally as follows: Vestiture darker in color, the elytra with greater areas of very dark brown scales. *Head* much more densely punctate, the crown densely and finely punctate, front confluently and rugosely punctate. *Rostrum* in the female more coarsely and closely punctate, rather evenly and coarsely punctate in the middle as well as on the sides at the base, the punctures elsewhere fine but close throughout; in the male very coarsely punctate and conspicuously carinate, the punctures between the carinae bristling with very closely placed stout, erect setae, the median and lateral carinae continuing nearly to the apex. *Prothorax* comparatively broader, broadly and rather evenly arcuate on the sides from the base to the subapical constriction which is conspicuously developed on the sides and distinctly interrupts the longitudinal dorsal outline; the disk is much more coarsely and closely punctate, the punctures not distinctly separated by the interstices but coarsely confluent throughout; there is no impunctate median area, but a vague longitudinal carina is present; closely set with short, erect or slanting, spatulate setae and scattered prostrate scales. *Elytra* with the humeri more distinct, rather prominent; intervals with single rows of short erect spatulate setae only,

without any sharp ones even in the male, and with scattered, usually prostrate, but often inclined, scales. *Legs* with the femora more closely and coarsely punctate. Length, 6-7 mm.; breadth, 2.5-3 mm.

Moala Island, Fiji. Holotype male, allotype female, and one female paratype collected by Mr. E. H. Bryan, Jr., from under bark, July 12, 1924.

A New Genus of Samoan Curculionidae (Coleoptera)

BY ELWOOD C. ZIMMERMAN
Bernice P. Bishop Museum

(Presented at the meeting of December 3, 1936)

I propose the generic term *Samoacis* for the reception of a peculiar new weevil from Samoa. It belongs to the subfamily Diabathrarinae and is allied to *Strongylorhinus,* an Australian genus.

I wish to thank Sir Guy A. K. Marshall for his help in ascertaining the relationship of this new genus.

Samoacis new genus.

Head flattened between the eyes and there narrower than the base of the rostrum; the eyes, from above, conspicuous, angulate and projecting laterally, set below the dorsum. *Rostrum* gradually expanded on the sides from the base to the apex, about as long as the head, flattened above, apex entire, rounded; scrobe beginning just behind the middle but with an evanescent sulcus extending anteriorly, deep, linear, slightly arcuate, oblique, passing downward to the lower margin of the eye. *Antennae* inserted just behind the middle of the rostrum; the scape rather short, clavate, about as long as the first four funicular segments; first funicular segment subglobose, as broad as long, almost as long as the following two segments together, twice as broad as two which is slightly longer than three, three to seven successively shorter and more transverse; club rather large, as long as segments three to seven inclusive, oval, apparently three segmented. *Prothorax* broader than long, the basal margin sinuous and broader than the apex. *Scutellum* conspicuous, not very large. *Elytra* sinuous and deeply emarginate in the middle at the base, much broader than the prothorax, the humeri abrupt, strong and broad, compressed dorso-ventrally; ten striate, the intervals broader than the striae. *Wings* fully developed. *Legs* with the femora rather strongly clavate, edentate; tibiae laterally compressed, rather stout, with a minute tooth at the inner apical angle, the corbels open, somewhat ascending, fringed with short setae; tarsi broad, the second segment strongly transverse, the

third deeply cleft, the fourth inserted near the base of the third and hardly extending beyond its anterior margin; the claws strong, divaricate. *Sternum* with the front coxae nearer the hind margin of the prosternum than the fore margin, narrowly separated by two projections of the prosternum, the anterior one larger and more pointed and separated from the posterior projection by a distinct gap; mesocoxae separated by a distance equal to three-fourths the breadth of a mesocoxa, the mesosternum protuberant between them; episternum somewhat larger than the epimeron; metasternum long, flattened, about twice as long as a posterior coxa at its narrowest point between the mid and hind coxae; the metepisternal suture distinct throughout; metacoxae widely separated by a distance about equal to one-third more than the breadth of a metacoxa. *Venter* with the intercoxal process arcuate, the first ventrite slightly longer than two, the second about as long as three and four together, the suture between one and two arcuate, and more or less fused in the middle, ventrites three to five subequal in length. Body scaly.

Genotype: *Samoacis planatus,* new species

This genus is allied to *Strongylorhinus* Schoenherr (1847), but is distinct from that genus in that the scrobes begin behind the middle of the rostrum and clearly reach the eyes, the antennae are inserted between the eyes and the middle of the rostrum, the first funicular segment is much longer than the second, instead of being shorter as in *Strongylorhinus,* the club is heavy and as long as funicular segments three to seven inclusive, the eyes are unusual, protuberant and angulate, the thorax is distinctly broader than long, the elytra are much broader than the thorax, with strongly developed humeri, and the fourth tarsal segment is not slender but rather stout. Besides these characters there are numerous others that will serve to distinguish *Samoacis* from *Strongylorhinus.*

Samoacis planatus new species (Fig. 1).

Derm reddish-brown, rather densely clothed above with elongate-oval scales, the majority of which are iridescent, interspersed with patches of brown scales; head with greenish and bronze scales; pronotum usually with the iridescent scales condensed to form a broad, pale median vitta, the scales toward the side usually brown, but often the iridescent scaling extends over the entire disk; elytra variably mottled with patches of brown and pale greenish or bronze iridescent scales, but usually with a small paler patch on each side of the scutellum and a variable, but usually conspicuous, common transverse pale band just behind the middle that is often very broadly and solidly V-shaped or triangular; legs clothed above with elongate greenish and bronze iridescent scales.

Head slightly impressed between and behind the middle of the eyes, front narrowed from the anterior to the posterior margins of the eyes; eyes subtrapezoidal when viewed from above, strongly protuberant, squamose behind, the distance between the lateral margins of the eyes much greater than the base of the head and slightly broader than the anterior margin of the prothorax, separated from the dorsum of the head by a sharply defined cliff-like sulcus. *Rostrum* with the dorsal outline forming a broad angle with the head, with a median dorsal impression, squamose to the epistome which is polished, bare and has a few scattered punctures; scrobes very deep. *Antennae* with the second funicular segment about as long as three plus one-half of four, four about as broad as long, the others successively more transverse. *Prothorax* broader than long (2:1.5), base broader than the apex in the same proportions, shallowly sinuate, apex usually truncate but sometimes very shallowly emarginate, almost straight on the sides from the base to the middle, where it is broadest, and thence narrowed to the apex; the longitudinal dorsal outline convex, higher in the middle than the base, slightly, transversely impressed before and behind the middle, the basal margin somewhat flattened, especially in the female; densely squamose, with rather large puncturs bearing curved, prostrate setae on the sides, the disk usually impunctate, or with at most a few scattered punctures. *Scutellum* densely squamose. *Elytra* about three times as long as the prothorax, longitudinally convex in the male, but greatly and conspicuously flattened in the female, the outline in both made somewhat uneven by some variable dorsal impressions, base sinuate, deeply emarginate in the middle, the humeri abrupt and angulate, the distance across them nearly twice the breadth of the prothorax (7:4), the elytra thence parallel-sided to the apical third from whence they are roundly narrowed to the apex; rather conspicuously angulate at the sides, the epipleurae more distinct in the female than in the male, the intervals flat, about twice as broad as the striae, densely squamose; strial punctures rounded or somewhat quadrate, deep, each bearing a hair-like seta, the striae on the disk deeper and more distinct than those on the epipleurae, stria ten feebly developed, at least behind the middle. *Legs* with the femora densely squamose above only, tibiae with scattered slender scales and setae, the apical denticle often difficult to see, tarsi with white setae above, spongy beneath, the claws strongly bent beneath. *Sternum* with the metasternum subconfluently punctate, transversely rugose and with scattered, prostrate, hair-like setae, but with elongate iridescent scales laterally. *Venter* with the ventrites rather uniformly finely punctate and rugulose, the punctures bearing fine, prostrate setae; ventrites four and five retracted and bent upwards in the female. Length, 3-3 5 mm.; breadth, 1.4-1.6 mm.

Tutuila, Samoa. Holotype male, allotype female, and two paratypes from Pago Pago, collected by sweeping, February 26, 1930, and three paratypes collected on the Leone-Aule trail, November 12. All were collected by Mr. D. T. Fullaway and are stored in Bernice P. Bishop Museum.

This species is most distinct from any other Samoan weevil. Its flattened form, protuberant eyes, and its short-claw segment will serve to distinguish it offhand.

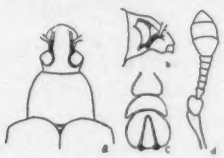

Figure 1. Diagrams of details of *Samoacis planatus*, new species: a, dorsal view of head, pronotum and base of elytra; b, lateral view of head; c, dorsal view of tarsus; d, antenna.

A Study of Blossom-drop of Tomatoes and Control Measures

BY J. F. ILLINGWORTH
Bishop Museum

(Presented at the meeting of October 1, 1936.)

For several years, as I have indicated in a former paper (see P.H.E.S., VII, 247) an immigrant bug* has been giving trouble to growers of tomatoes in Hawaii. During September, 1936, I had an opportunity to make further observations on this pest, and to experiment with methods of control.

In my garden at Kaimuki I had a very large plant of the small pear-shaped tomato. The runners had been trained up onto an iron frame so that they reached a height of about eight feet. This plant bore prolifically, but suddenly ceased, though the foliage was luxuriant. I found that the tips of the branches were infested with great numbers of these mirid bugs, and that practically all the blossoms dropped before they opened. The newer growth showed sunken, purplish rings, both around the stems and around some of the leaf stalks. The stems have a tendency to break easily at these injured places. The rings are evidently caused by the feeding of the bugs. Sections through the rings show only dead, corky cells, with no suggestion of egg-punctures. On older stems there is some swelling on either side of the ring; evidence that the plant is covering the injury. Since the tips of the branches, especially around the unopened flower buds, were swarming with nymphs in all stages, I concluded that the eggs must be inserted in this portion of the plant, though I was not able to locate them. However, when I placed the unopened flower buds in a glass tube, many nymphs hatched from them. Furthermore, the few flowers that did open, developed abnormal fruits, with rings of scars. These appeared to be egg-punctures. In one of these rings, extending entirely around the fruit, I counted more than 30 punctures, which when opened showed only corky tissue. In one instance a nymph was discovered, when a tiny fruit with a ring of punctures was sectioned.

The nymphs pass through five stages in about nine or ten days. The first stage nymphs are yellowish with very conspicu-

* *Cyrtopeltis varians* (Dist.), formerly determined as *Engytatus geniculatus* Reuter.

ous red eyes. Second stage, lighter color, more greenish and active, eyes brown. Third stage, greener body, yellowish head, nodes and distal segment antennae blackish. Fourth stage, more green, wing pads beginning to show, eyes blackish. Fifth stage, very green, eyes darker, wing buds reaching one-third the length of the abdomen.

The adult bugs are very active, especially during the warm, sunny part of the day. They can be seen flying over the plant, and even to some distance.

Control Measures.—As I have suggested previously, a pest of this kind should not be difficult to control. Any good contact spray ought to do the work. I tried "Penetrol" and Pyrethrum extract with success, spraying the plant at weekly intervals. Later, I tried out a spray of straight Deo-Base oil, with Pyrethrum added in the same strength as used in household sprays, i.e., one quart Pyrethrum 20 to five gallons of the oil. This gave splendid results in killing the bugs, and when applied in a very fine fog did not damage the foliage.

Observations on the Predaceous Habits of Cyrtopeltis varians (Dist.)[1] (Hemip.)

BY J. F. ILLINGWORTH
Bishop Museum

(Presented at the meeting of November 5, 1936.)

While making a study of this tomato blossom blighter, I saw the bugs with their beaks inserted in plant lice. Following up this observation, I found that they eagerly sought out other forms of insect diet. As early as October 16, 1929, Rosewall and Smith,[2] of the Louisiana Experiment Station, discovered this habit.

Dr. Rosewall and Mr. Smith were making observations on corn earworms, *Heliothis* spp., when they discovered both adults and nymphs of these bugs with their beaks inserted in the eggs of the moths. They, also, found them feeding on the young larvae.

[1] Mr. Robert L. Usinger called my attention to a change of name; the species heretofore determined as *Engytatus geniculatus* Reuter, (Rev. Ap. Ent. Ser. A.22, 421).

[2] Rosewall, O. W., and Smith, C. E.—The predaceous habit of *Cyrtopeltis varians* (Dist.) Jour. Econ. Ent. XXIII, p. 464, Sc. notes. 1930.

In my life history work I, at first, found difficulty in carrying the bugs through on shoots of tomato. They disappeared after two or three moults. I was never able to see them preying upon one another, though they were frequently observed chasing each other. They are decidedly wary and not at all gregarious. Several times I found dead nymphs on the blotter in the bottom of the cages.

Getting new material, I found that aphids on the tomato slips had been sucked dry, so that only their dead, empty skins remained. Following up this observation, I got some pineapple mealybugs, in all stages on beans, and put them into the cages. At once the young mealybugs migrated onto the tomato slips, where the mirids were soon observed probing them with their beaks. Even the second stage nymphs of the mirids were very active in their search for the very tiny mealybugs. After a few days most of this food supply had been used up. The mirid nymphs took on a different appearance. They were less green in color—the darker stomach contents showing conspicuously through the transparent wall. The mirids thrived on this diet, and I was able to carry them along successfully without any losses.

Eggs of cabbage butterfly on nasturtium leaves were equally relished by the mirid nymphs, and in a few instances they fed upon the newly-hatched caterpillars. They acted afraid of larger caterpillars, and left them alone.

All of this evidence shows that even our worst pests may sometimes be an important factor in Nature's balance.

NOTICE OF SEVENTH INTERNATIONAL CONGRESS FOR ENTOMOLOGY, BERLIN, 1938

By Resolution adopted by the Executive Committee for International Congresses for Entomology, the *Seventh International Congress for Entomology* will convene in Berlin from August 15th to 20th, 1938.

Discussions will be held in the following sections and on the subjects indicated below:

A. *General Entomology:*

(1) Systematism and Zoogeography. (2) Nomenclature and Bibliography. (3) Morphology, Physiology, Embryology and Genetics. (4) Oecology.

B. *Applied Entomology:*

(1) Medical and Veterinary-medical Entomology. (2) Agriculture and Sericulture. (3) Forest Entomology. (4) Agricultural Entomology: (a) Viticulture and pomiculture; (b) Agriculture and olericulture; (c) Vermin. (5) Means and methods for fighting vermin.

The management of the congress should deeply appreciate the participation of numerous Representatives of Scientific and Practical Entomology in the Congress to be convened in Berlin.

All entries for participation, and all inquiries, should be addressed to the Secretary General, Professor Dr. Hering, Invalidenstrasse 43, Berlin N. 4.

PRESIDENTIAL ADDRESS*

Observations on Beekeeping in Hawaii

BY C. B. KECK
U. S. Bureau of Entomology and Plant Quarantine

Beekeeping in Hawaii dates from 1857, when the first bees were said to have been introduced from California.[1] It is assumed these bees were the German or black race of bees. Later, according to his own statement to the writer, the late Mr. Gerrit P. Wilder introduced the first Italian bees. The bees now in Hawaii are mixtures of these two races. Hawaii boasts of some of the largest apiaries in the world, although during the last 10 years, when the price of honey was low, some of these apiaries have diminished in size. Now with improving markets increase is being made in the number of colonies in most apiaries.

Prior to the effective biological control of the sugarcane leafhopper (*Perkinsiella saccharicida* Kirk.), the bulk of export honey from Hawaii was "honeydew" honey, a sweet secretion of the sugarcane leafhopper and aphids, or a mixture of honeydew with floral nectar, and was considered a poor grade of honey. It was consumed principally by the baking trades. So notorious was the reputation of Hawaiian honey for containing honeydew that it is still thought on the mainland that Hawaiian honey is mixed with honeydew. As recently as December 1936 there was discussion at the State Beekeepers Convention at San Bernardino, Calif., of ways and means of keeping Hawaiian honeydew from the markets of California. Since there were two beekeepers from Hawaii present at this meeting the beekeepers of California were assured that since the control of the sugarcane leafhopper in Hawaii honeydew honey was not produced in surplus quantities.

During the past seven years the writer has kept from two to twelve colonies of bees as a hobby and has visited several commercial apiaries in Hawaii. During this time many casual obser-

[1] Coffey, Heber, E. A Malihini Views Hawaiian Beekeeping. Amer. Bee Jour., Sept. 1934; pp. 402-403.

* President Keck was absent on the mainland at the time of the annual meeting, December 3, 1936. This paper was turned in after his return.—[Ed.]

vations have been made concerning commercial honey plants, lesser honey plants, the importation of queens, average colony production, and the possibilities for the increase of colony production. It is the purpose of this paper to record some of these observations with suggestions which may prove helpful to beekeepers in Hawaii. It is, however, only as a private beekeeper that the writer wishes to speak and he does not in any way speak for, or represent, the Bureau of Entomology and Plant Quarantine of the U. S. Department of Agriculture.

Conditions Favorable to the Beekeeper in Hawaii.

There is practically no time during the year in Hawaii when a colony of bees of reasonable size cannot gather nectar and pollen to maintain itself. In the lowlands there is no time during the year when the colony needs to form a cluster to keep warm. Robbing, which is such a nuisance among bees on the mainland, seldom occurs in Hawaii because there are always a few plants blooming which supply a little nectar and pollen to occupy the bees. However, robbing cannot be ignored in large apiaries, when there is a dearth of nectar and hives are opened.

Although algaroba or kiawe (*Prosopis juliflora* (Sw.) De Candolle), is the main source of honey in the islands there are other plants such as eucalyptus, lantana, coconut, and others which may produce surplus honey if the beekeeper will move his bees to areas where these plants are plentiful during the honey flow from them. These plants are also very important for supplying stores for winter and for spring brood rearing.

Conditions Unfavorable to Beekeeping in Hawaii.

The amount and time of rainfall are likely to influence the amount of honey gathered more than any other climatic factors. On the island of Oahu, especially, misting rains which drift down the valleys may reduce the amount of honey produced. During the season of 1936 in the vicinity of the University of Hawaii the honey crop was reduced approximately 50 percent, in the opinion of the writer, because of almost constant misting rains. During this period actually only a small amount of water fell, but misting showers occurred for prolonged periods, practically every day.

Of the serious brood diseases of bees, only American foulbrood caused by *Bacillus larvae* and sacbrood caused by a filterable virus are present in Hawaii. A bacterial disease known as European foulbrood does not occur in Hawaii so far as is known by the author. It is very necessary that the commercial beekeeper become familiar with the symptoms of American foulbrood and sacbrood since these two diseases do not respond to the same treatment.

Ants may become serious pests around the apiary but usually do not cause trouble if the colonies are strong. It is advisable, however, to place hives on hive stands constructed in such a way that a small amount of sticky tree-banding material or oil applied to the legs of the stand will protect the colony from ants.

The giant toad *Bufo marinus* (Linné) is said to relish bees as a food. Examinations have been made many times to determine if this toad was eating bees in the writer's small apiary. Although toads are known to be breeding only about 20 yards away none have been found in the apiary. It is believed that this is due to the protective location of the apiary and it is suggested that in the location of the apiary the prevalence or accessibility to toads should be considered. It is further suggested that to protect individual colonies from toads they be elevated at least 18 inches from the ground and a sheet of quarter inch mesh wire screen be secured as an extension for at least 12 inches to the front of the alighting board of the hive and on the same plane with it. This wire will act as a shield to prevent the toads from jumping up and catching the bees. Adequate ventilation of the hive will also help in preventing "hanging out" at the entrance of the hive in the evening when toads become active.

There is no Territorial agency that specializes in beekeeping or carries on research to which the beekeeper can go for expert information, nor is there inspection for brood diseases, although this was done for one season by the Board of Agriculture and Forestry as an extra activity.

Management that will Aid Production.

While beekeepers in Hawaii, for the most part, use standard hives, in some cases they do not use full sheets of foundation in completely wired frames or full sheets of reinforced wire founda-

tion in frames with one or two wires as starters for brood combs and extraction combs. This is false economy since brood and extracting combs will last for as long as 20 years when produced and cared for properly. When only strips of foundation are used in the brood nest large areas of comb are drawn out as drone cells, and the drones produced only reduce the surplus honey and crowd the brood nest, which is one of the main causes for swarming. If wire reinforcement is not used in the foundation to produce extracting combs, excess breakage results in the extracting process.

There is an enormous difference in the average production per colony in different commercial apiaries. In one apiary with approximately 2,000 colonies the yearly expected average is from 30 to 50 pounds while in another apiary of approximately 500 colonies an actual average of 192 pounds of extracted honey was obtained during the season of 1936. The 192 pound average of extracted honey does not appear to be an unusual crop of honey when one or two colonies in small back-yard apiaries will produce from 200 to 225 comb-honey sections in a season. It is well-known that a colony of bees will produce approximately one-third more extracted honey than comb honey. It appears reasonable to assume that if a commercial apiary has an average production of less than 100 pounds per colony there is something wrong with the management. The successful honey producer should have his colonies built up to maximum strength at the beginning of the honey flow. One essential for a strong colony is a vigorous young queen. The queen is the main part of the colony since she lays all the eggs for the colony. A strong colony at the peak of the season may contain as high as one hundred thousand workers. Since workers live only from 6 to 8 weeks during the active season the queen must lay about 2,000 eggs per day to maintain the colony. In Hawaii, brood rearing continues throughout the year and this adds an extra burden on the queen. The bees instinctively replace or supersede the queen when she shows signs of failing, and she is most likely to fail during the peak of brood rearing. Therefore, since there may be a break in egg laying of from 1 to 3 weeks during supersedure, the surplus or beekeeper's portion of the honey crop is reduced. The beekeeper can avoid the possibility of supersedure by supplying each colony with a young queen

from 1 to 3 months before the peak of brood rearing. It is the writer's opinion that this should be done, in Hawaii, about February of each year, and this has been borne out by experience.

To obtain young vigorous queens it is believed that best results will be had by rearing one's own queens from eggs from a queen imported from a reliable queen breeder on the mainland. The trip by steamship to Hawaii is so severe that to secure queens from mainland producers to head honey-producing colonies in Hawaii is almost certain to produce supersedure during the succeeding honey flow; furthermore, queens are not available on the mainland at the time when needed most in Hawaii. If the beekeeper is isolated or has a large number of colonies, queens of practically the same breeding as the original mainland queen can be produced by requeening all colonies twice with queens reared from eggs from the mainland queen. A period of approximately 3 months must elapse between each requeening in order to eliminate all hybrid drones which were originally present in the apiary and with which the first set of queens would naturally mate. The first set of daughters of the mainland queen will produce hybrid workers (each worker will be of half mainland stock and half hybrid stock) and drones will be produced which are of pure mainland stock since the drone is from an unfertilized egg. Therefore, a second requeening, after 2 or 3 months has elapsed, with queens reared from eggs from the original mainland queen, will result in workers of pure stock, since the drones present at that time are of the original mainland stock provided the apiary is isolated from hybrid bees. The original mainland queen may be kept for several years as a breeder if she is kept in a weak colony to make it easier to guard against supersedure.

It should be the aim of the beekeeper to have his colonies built up to maximum strength just before the blooming of the main honey plant. During the off honey season colonies are usually reduced to 15,000 bees, while at the peak of brood rearing the colony should contain at least 60,000 bees. It was found by Farrar[2] that a colony containing 60,000 worker bees will produce 1.54 times as much honey as four colonies each with 15,000 bees.

[2] Farrar, C. L. The Influence of Colony Populations on Honey Production. Jour. Agr. Research, Vol. 54, No. 12, pp. 945-954, June 15, 1937.

Honey Plants and Their Seasons.

The beginning of the honey flow from algaroba may vary from 1 to 3 months, depending upon rainfall and other climatic conditions. This is also true of the other lesser honey plants. The beekeeper should study the sources of nectar in his locality as well as the succession of honey flows available to him. By migrating from algaroba to eucalyptus and lantana, surplus honey for brood rearing in building up colonies for the next crop may at least be obtained. In a location where lantana was blooming during March and April of 1937, a colony produced about 35 sections of comb honey. The writer suggested to a commercial honey producer that a few colonies be moved to a eucalyptus area after the algaroba flow was over. This was done during the season of 1936 and approximately 30 pounds of eucalyptus honey per colony was obtained. It is the writer's opinion that this surplus from eucalyptus should be left with the colonies to aid in brood rearing in building up for the algaroba flow instead of forcing the colony to delay brood rearing until the algaroba flow starts and then build up an excess population at the expense of the honey crop. The algaroba flow may occur as early as April or be retarded by dry weather until July, and the beekeeper should be able to estimate in advance the time when the next bloom will occur. The eucalyptus flow appears to be more uniform as to time and occurs in August usually after the algaroba flow is over. The lantana honey flow depends, more than either algaroba or eucalyptus, upon rainfall as to the time of its occurrence. It is not known to the writer whether or not lantana blooms profusely twice yearly but blooming and consequent honey flows have been noted both late in the fall and early in the spring. There is an almost continuous light bloom on lantana throughout the year if moisture conditions are right. A very light flow may be gotten from coconut for almost the entire year if the bees are close to a large coconut grove.

The lesser honey plants in Hawaii are almost too numerous to mention. There is hardly a time when a small number of plants of some variety are not blooming and furnishing nectar and pollen for brood rearing and perhaps a little surplus for the beekeeper.

The Need for Inspection Service and Research.

Earlier in this discussion mention was made of the need for inspection of apiaries for brood diseases in Hawaii. A request for such a department to be added to the Entomology Department of the Board of Agriculture and Forestry was made of the 1937 legislature by the beekeepers of Hawaii. This met with a favorable response but nothing was done about it during the 1937 session. There is a great need for such a department with a trained apiculturist in charge. Inspection can only be done thoroughly by a government agency. The most serious brood disease, American foulbrood, is a disease of strong colonies, that is, it often shows up in the strong colonies of an apiary first. The honey of the diseased colony becomes contaminated with the spores of the causal organism, *Bacillus larvae*. The strong colonies in the neighborhood will rob from the diseased colony, which is now so weakened by disease that it falls easy prey for a strong colony. Therefore, the only protection for the commercial beekeeper is to have all bees in the neighborhood inspected by some governmental agency. Even though a careful beekeeper cleans up all infection in his own apiary, his apiary may be continuously exposed to reinfection by other bees in the neighborhood which are not well kept. Definite progress has been made in the past few years in the artificial insemination of queen bees, and this in the future may permit of the controlled mating of queens. Other experiments and observations indicate that there do exist strains of bees which are at least partially resistant to American foulbrood and even now queens are being reared from stock which shows apparent resistance. It was indicated to the writer on a recent trip to the mainland that as queens are available it would be desirable to send queens to some governmental agency in Hawaii for testing for disease resistance under Hawaiian conditions. If a disease-resistent strain is found, it would be of great value to beekeepers of Hawaii to be able to obtain stock. The addition of an apiculturist to the staff of the Board of Agriculture and Forestry well deserves the support of the Hawaiian Entomological Society.

Records of Immigrant Insects for the Year 1936

BY THE EDITOR

In this issue of the Proceedings, the following new immigrant insects are recorded. Those marked with an asterisk were observed for the first time at the date mentioned. The others have been previously collected, but herein named or recorded for the first time. For details of records, etc., refer in the text to the pages given.

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